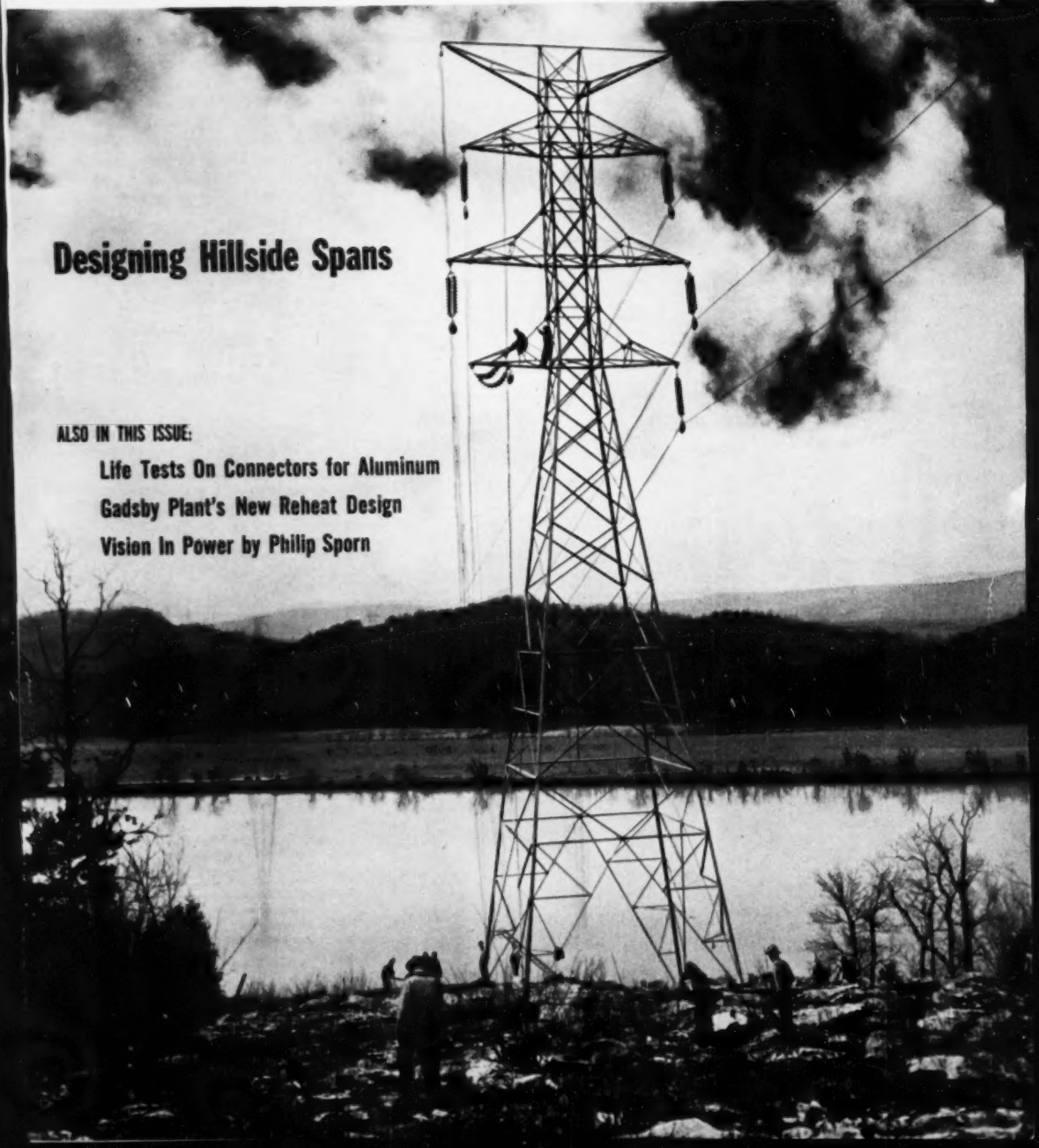
JUNE 2, 1952

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION



Designing Hillside Spans

ALSO IN THIS ISSUE:

Life Tests On Connectors for Aluminum

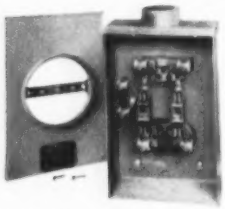
Gadsby Plant's New Reheat Design

Vision In Power by Philip Sporn

SIMPLIFY your meter mounting problems....choose from the COMPLETE Murray line

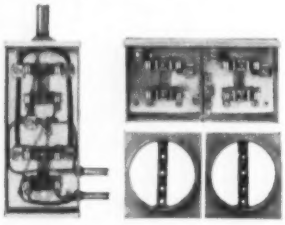
OUTDOOR METER SOCKET

Single or multiple units (saves nippling in the field). Provisions for fifth and sixth jaws. Reversible jaws for vertical or horizontal mounting. Two or three hubs—1" or 1¼". Pressure connectors. Finished in grey baked-on Melamine (a really rugged finish).



OUTDOOR WEATHERPROOF—RAINTIGHT METER SOCKETS

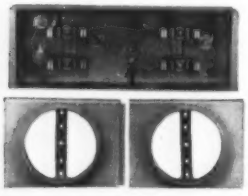
A medium duty socket. Contact surfaces of jaws are silver plated. Single phase installation can be converted to polyphase by substituting polyphase blocks. Sturdy cabinet, built of corrosion resistant steel. The finish is baked-on Melamine. Deep tipped top with hub for 2" conduit, is welded to sides and back. Cover slides under top, over sides and bottom, making device completely raintight. An economical unit.



OUTDOOR SOCKET METER TROUGHS

(Vertical or Horizontal)—

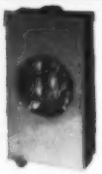
Single or multiple units. On multiple units, line and load terminals at each meter position are lay-in pressure type connectors, which simplify bussing. Line connectors for #4 to #3/0 cables. Load connectors for #4 to #1/0 cables. Made in sizes to accommodate from one to six meters.



INDOOR SOCKET METER TROUGH

(Horizontal)—

Available in one to three meter positions. Can be ganged readily. Line and load terminals are pressure type. Line connectors for #4 to #3/0 cables, load connectors for #4 to #1/0 cables. Lay-in connectors simplify wiring.



TYPE H.D. HEAVY DUTY METER MOUNTING DEVICE

Has a maximum continuous carrying capacity up to 200 Amperes. Can be used with any standard 4 or 5 terminal meter on 1, 2 or 3 phase, 3 wire installations. Where the standard 50 Ampere meter is used, the heavy duty mounting is suitable for 200 Amperes intermittent duty and 150 Amperes continuous duty. Vise-jaw terminals for high-strength, high conductivity. Pressure connectors take line conductor sizes from #6 to #4/0. Equipped with transparent acetate shield for safety in installation and testing. By-pass clamps permit removal or testing of meter without interrupting load. Corrosion resistant, weatherproof case. Supplied with 2" or 2½" hubs.

MODIFIED OUTDOOR SOCKET METER TROUGH

An economical device for those whose requirements call for a compact, single position unit. Plenty of wiring room. All connectors are pressure type and take up to #1 wire. 1" or 1¼" hubs available. Melamine finish.

COMBINATION METER SOCKET AND SERVICE CONTROL EQUIPMENT

Murray meter sockets are available in combination with service control equipment. Factory assembly assures a rock-solid, perfectly aligned unit. Service control equipment includes Fully Magnetic Circuit Breakers. Murray Magnetic Breakers always carry the full load, are never affected by ambient temperatures. The sun's rays, for instance, will never cause Murray Breakers to trip. Both socket and service control equipment are finished in baked-on grey Melamine.

Murray can fill all your needs for socket type meter mounting equipment. You can choose any device you need—from the round socket to heavy duty equipment. Ordering and stocking or specifying are simplified when you buy from one source.

Murray

MURRAY MANUFACTURING CORPORATION

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Service Entrance & Meter Equipment • Magnetic Circuit Breakers • Switches • Current Limiting Reactors • Crow'nest Aerial Ladders.

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Please send me the catalog page and any other literature on the items listed below.

1. Outdoor Meter Socket ☐
2. Outdoor Weatherproof—Raintight Socket ☐
3. Heavy Duty Meter Mounting Device ☐
4. Outdoor Socket Meter Troughs
   - Vertical ☐
   - Horizontal ☐
5. Modified Outdoor Socket Meter Trough ☐
6. Indoor Socket Meter Trough ☐
7. Combination Meter Socket and Service Control Equipment ☐

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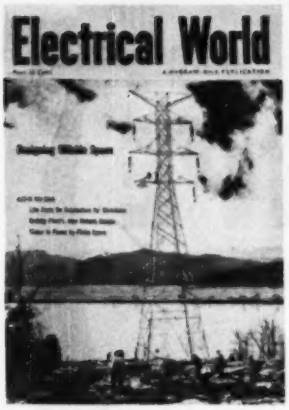
Address _____

City _____ State _____



ON THE COVER . . .

. . . linemen are shown at work building a double circuit 161-kv transmission line from Widow's Creek Plant of the Tennessee Valley Authority.

In a coming issue will be an article on TVA's rapid expansion. The nation's first big federal power project will soon be its largest supplier of electric energy. By the end of 1955 it may have 8.1 million kw in operation, two thirds of it steam. A map will locate the various projects. And pictures of its executives and of projects under construction will provide additional illustrations.

EEI's 20th ANNUAL CONVENTION

In 1933 Edison Electric Institute held its first convention at Chicago. This year by conveniently forgetting that the 1945 convention was held in miniature because of wartime travel restrictions the Institute will hold its 20th meeting at Cleveland.

On hand to assure the coverage such an important meeting deserves will be eight members of the Electrical World staff. The job they do will be reflected by the June 9 issue which will feature the Coffin Award winner.

But a better reflector will be the annual EEI Convention Number due June 16. Here complete news coverage of the convention, including election of officers and prize award winners, will be backed by the abstracts of the ten major speeches to be presented.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y.** Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow ten days for change of address.

Subscriptions are accepted only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and possessions $6 a year, $9 for two years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. **Entered as second class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879.** Printed in U.S.A.

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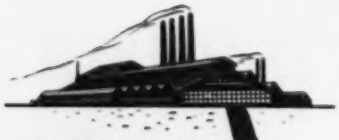
ELECTRICAL POWER IN A PIPE ...AT 230,000 VOLTS



Transmitting electrical power through a pipeline is today the accepted method of carrying large blocks of power underground. Already this system has been specified for the first 230,000 volt underground circuit in the western hemisphere. It will be supplied by Okonite, originator of the Oilostatic high oil pressure pipe-type cable system.

Oilostatic, used principally by public utilities, may be only of academic interest to you. But as a symbol of the high level of research and development continually carried on at Okonite, it is of major importance to everyone concerned with the handling of electricity.

For Okonite research has made it necessary to judge electrical cable by a whole new set of standards. Developments in recent years have extended the life expectancy of cables well beyond any previous norm. Higher voltages are handled with ever-greater security. New designs and constructions have immunized modern cables against such bugaboos as heat, flame, moisture, weather and ozone to a greater degree than ever before.

If you are not already familiar with the new criteria of electrical cable performance, available through Okonite's broad line of proved cables, we urge you to get in touch with your Okonite representative, or drop us a line. The Okonite Company, Passaic, N. J.

Fiftieth ASTM *Anniversary*

EXHIBIT AND MEETING
JUNE 23-27 IN NEW YORK CITY

OKONITE

SINCE 1878

insulated wires and cables

THE RIGHT TOOLS—
right when they're needed

For prompt, efficient completion of any line job, make sure your linemen have the right tools — *right* when they're needed.

And, for the easiest way to obtain this equipment, make it a point to order from Graybar. On a single transaction, you can get pliers, wrenches, shovels, and all the other tools you need for line construction and maintenance . . . safety equipment for hot-line repairs . . . even trailers and splicing carts.

By ordering through Graybar, you save the time and expense of multiple inquiries. You get products that are dependable and give long service-life—products that have been tested and accepted by linemen throughout the nation.

Your local Graybar Representative is a convenient source of information on all of the other materials required for utility pole-line projects. You'll find him well-informed on both availability and usage of the more than 100,000 electrical items distributed by Graybar.

Remember, too, that for special help on difficult problems, an experienced Graybar Outside Construction Specialist is at your service.

Graybar offices and warehouses are strategically located in over 100 cities — a feature that enables us to give you efficient local service on day-to-day orders and often saves valuable time in emergencies. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.*

214-96

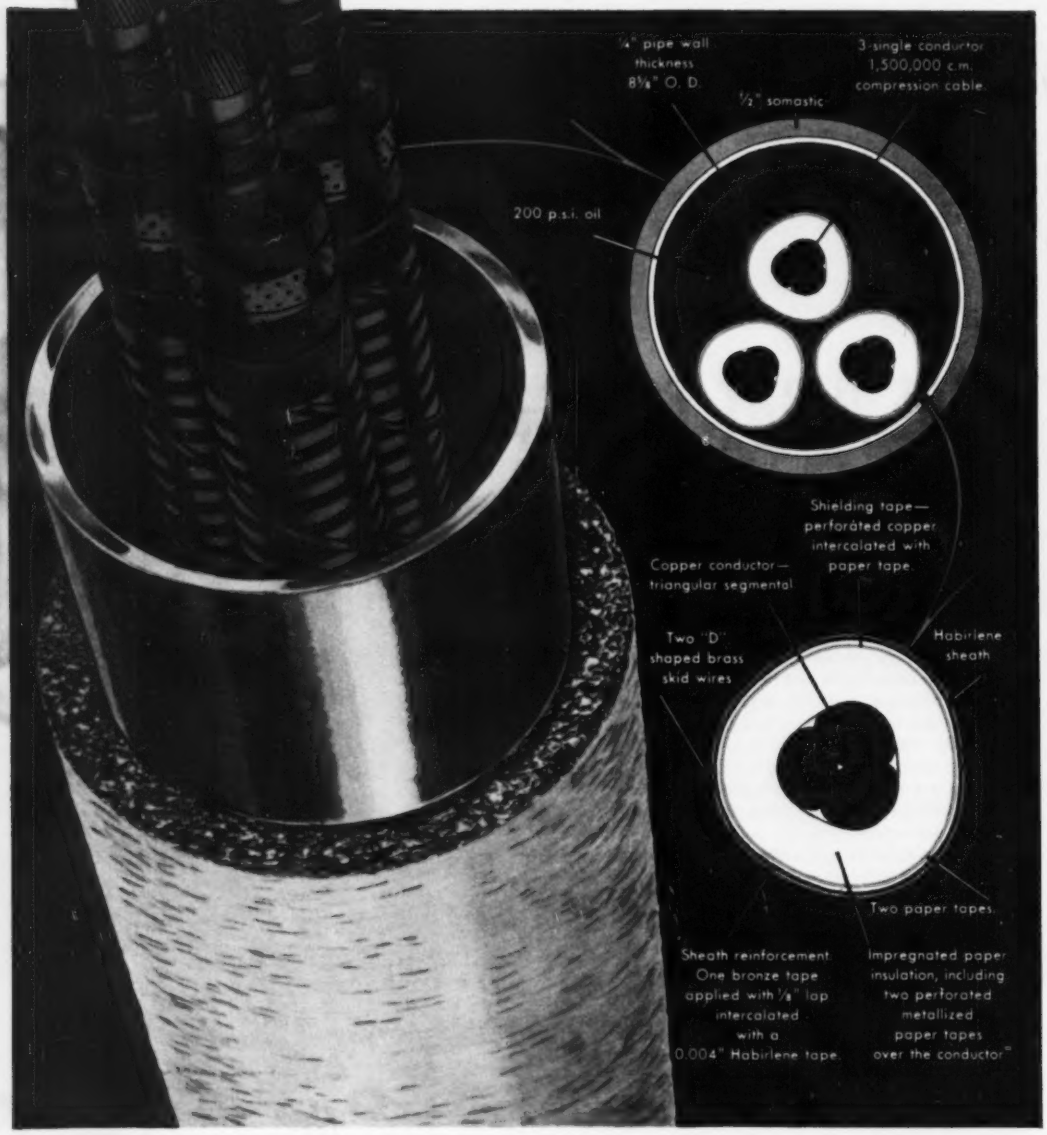
You get the best of everything electrical

Via GraybaR

IN OVER 100 PRINCIPAL CITIES

FIRST IN U.S. WITH

New High-Voltage Compression


¼" pipe wall thickness 8⅝" O. D.
3-single conductor 1,500,000 c.m. compression cable
½" somastic
200 p.s.i. oil
Shielding tape—perforated copper intercalated with paper tape
Copper conductor—triangular segmental
Two "D" shaped brass skid wires
Habirlene sheath
Two paper tapes
Sheath reinforcement One bronze tape applied with ⅛" lap intercalated with a 0.004" Habirlene tape
Impregnated paper insulation, including two perforated metallized paper tapes over the conductor

161,000-VOLT RATING

Cable will Serve Air Force Wind Tunnel!

Underground installation employs latest design 3-segment copper conductor cable in welded steel pipe under oil pressure of 200 pounds per square inch

This is the first installation in the United States of high-pressure pipe-type cable specifically designed for 161,000-volt rating for use on a system which will operate at a nominal voltage of 154 kv.

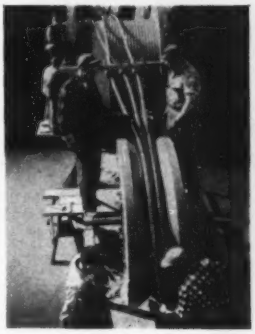
It was designed and manufactured by Phelps Dodge Copper Products Corporation for the U. S. Air Force for installation at the Arnold Engineering Development Center in Tennessee.

Of particular interest is the impervious polyethylene sheath which was selected after a study of all available types because of the protection it provides against contamination during the pulling-in process, its ease of installation and its permanent protection to the cable insulation throughout the operating life of the cable.

Arrangement of testing equipment at the Center required that the main substation receiving the power supply from the transmission system feed four other substations. The feeders had to be underground because continual movement of large jet aircraft under test prohibited the use of overhead lines.

The total circuit length of installation is approximately 8,000 feet. One complete transformation was saved by continuing voltage to substations at incoming supply level. Thus the installation demonstrates again the economy and practicability of transmitting extra high voltage power via the compression cable system.

Cable will relay high-tension power to jet proving grounds—including new wind tunnel—at Tullahoma, Tennessee.



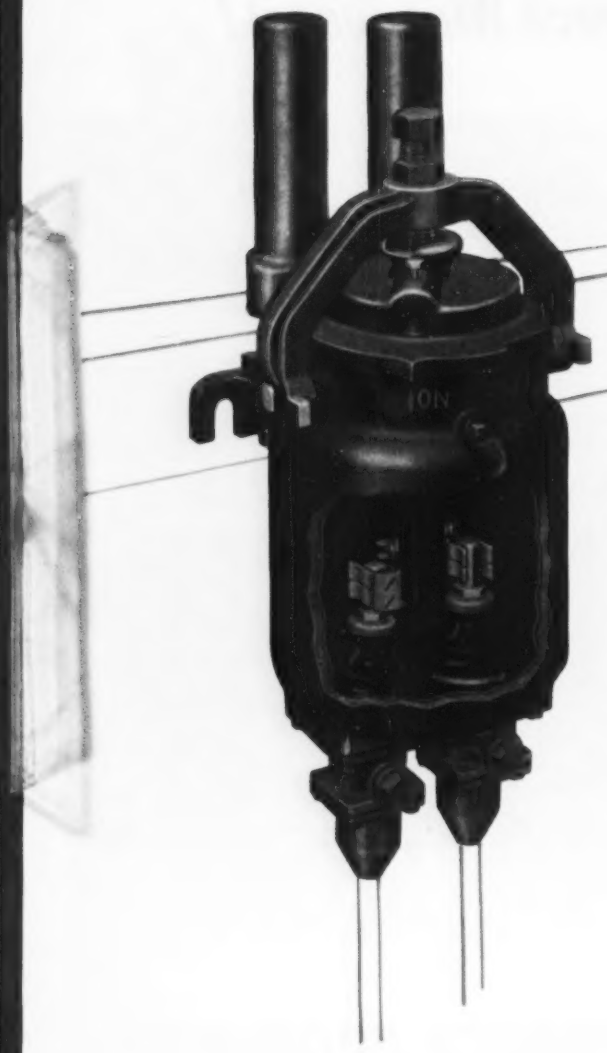
Here the three compression cables are being drawn simultaneously into the steel pipe.

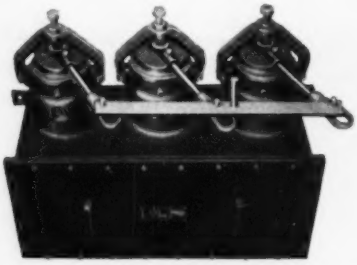
Particular care is taken to insure protection against corrosion at all pipe joints.

PHELPS DODGE COPPER PRODUCTS

CORPORATION

CAST STEEL TANK (HERMETICALLY SEALED—OIL FILLED) PROTECTS MEN AND EQUIPMENT BY SAFELY WITHSTANDING HIGH PRESSURES OF HIGH VOLTAGE FUSE CLEARING A HEAVY SHORT CIRCUIT





"FC" OIL FUSE CUTOUTS

2500 — 5000 — 8000 VOLTS

In addition to the main purpose—a pressure tight enclosed fuse—the device serves as a full load break oil switch. The gang operating mechanism provides for three phase sectionalizing. The switching contacts are Beryllium copper. Fuse links are simple and inexpensive, easily replaceable in the carrier on the removable cover of the cutout tank.

Welded steel boxes with cutouts on top, enclose connections to feed and load circuits.

Bulletin CA50 gives data and prices. Write for a copy or ask your representative.

G&W "FORETHOUGHT" CD1-3 SHOWS HOW "FC" CUTOUTS ARE COMBINED WITH "DAL" OIL SWITCH. SEND FOR YOUR COPY, THERE IS NO OBLIGATION.

G & W ELECTRIC SPECIALTY CO.

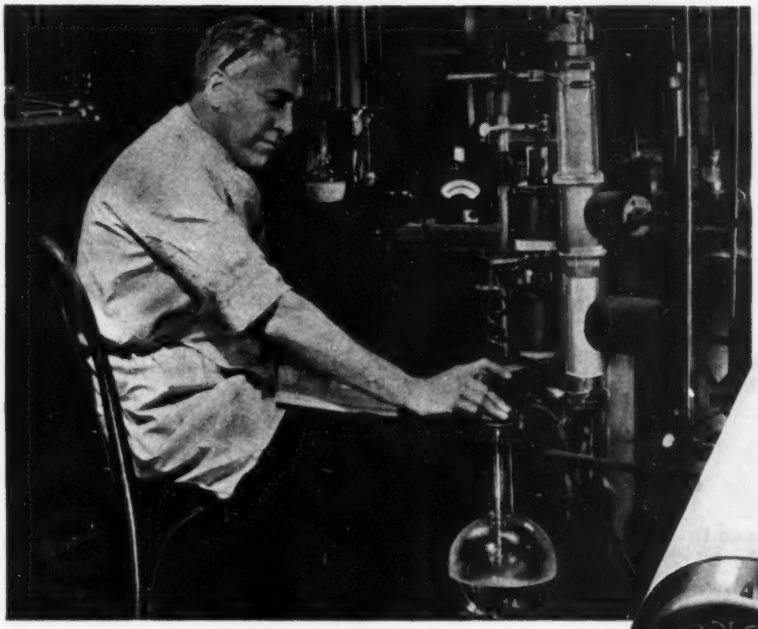
7780 Dante Avenue, Chicago 19, Illinois

Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U. S. A.

In Canada—Powerlite Devices, Ltd., Toronto and Montreal

Rare gases up light and efficiency of new lamp



A Westinghouse Research Engineer is shown operating the rare gas apparatus in which the new krypton and argon gas fill were developed. As a result of krypton-argon, the new Westinghouse 90-watt fluorescent gives 6% more light for only 2% more current.

NEW WESTINGHOUSE 90-WATT FLUORESCENT LAMP

The light and efficiency booster in the new Westinghouse 90-watt fluorescent lamp is krypton-argon. This gas fill, exclusive with Westinghouse, takes only 2% more current to jump light output 6%. And after 7500 hours, this new lamp will still outshine every other lamp in its class.

The new 90-watt will fit present 85-watt fixtures. It will hold the level of light above your minimum foot candle value longer. It'll reduce annual cost of light. Contact your nearest Westinghouse Lamp Sales Office for more information.

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UNDER-POWERED
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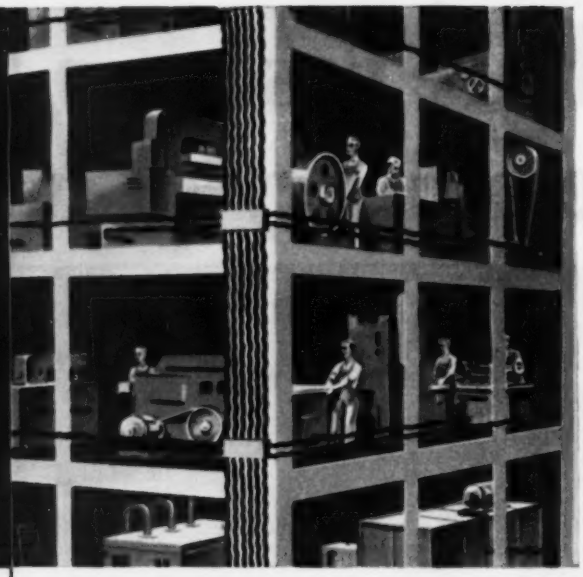
GET UP TO 50% ADDITIONAL POWER

WITH
ROCKBESTOS A.V.C.®
WITHOUT REPLACING
PRESENT CONDUIT



Here's How You Benefit

Use Same Size Cable . . . get ⅓ to ½ more current.

Use Present Conduit and Fittings . . . save on steel.

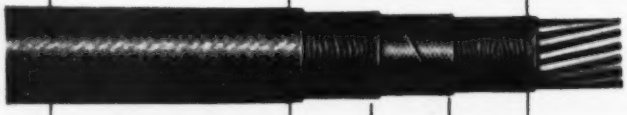
Installation Costs Are Low . . . cable size remains the same, is easy to pull through conduit. Using present conduit eliminates costly installation.

No Building Repairs . . . because you use existing conduit, there are no walls to repair, no weakened beams or partitions to repair.

A Time Saver . . . Old buildings or new, Rockbestos A.V.C. is a dollar-saver, and time-saver. Write for booklet "Rx for a Building with Hardening of the Electrical Arteries."

Have electrical loads outgrown your power requirements? You can increase your capacity up to 50% by merely replacing the present cable with Rockbestos A.V.C. . . . *the cable with the higher ampere rating.*

IT'S THE **A.V.C.** "SANDWICH"
THAT MAKES THE DIFFERENCE



This "sandwich" protects the varnished cambric. It enables A.V.C. to carry more current than cables with conventional insulations.

Outer Felted Asbestos Wall	Varnished Cambric	Inner Felted Asbestos Wall

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN. • the originators of **A. V. C.®**
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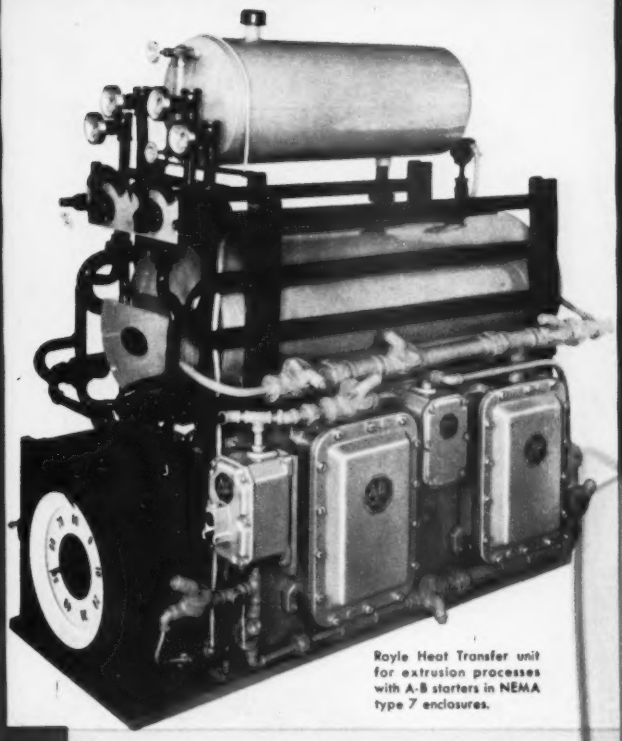
Hi ...*Your best buy*

Where
BOLTED ENCLOSURES
are a **MUST...**

Specify

A-B Quality

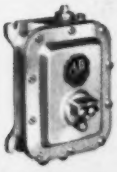
TROUBLE FREE STARTERS



Royle Heat Transfer unit for extrusion processes with A-B starters in NEMA type 7 enclosures.

NO CONTACT MAINTENANCE

Bulletin 609 manual starter in NEMA type 7 enclosure for hazardous gas locations.



Bulletin 709 Form 1 magnetic starter in NEMA type 7 enclosure for hazardous gas locations.

Freedom from contact maintenance is, of course, desirable in any motor starter . . . but especially so for controls in safety enclosures with bolted covers.

It is never easy to unbolt and replace heavy cast iron covers for routine inspections. That is why electricians and plant engineers specify Allen-Bradley trouble free motor controls. They know from experience that Allen-Bradley switches with double break, silver alloy contacts will operate for months . . . and even years . . . without requiring even contact inspection. They know also that the simplicity of Allen-Bradley starters means freedom from trouble . . . hence, freedom from production stoppages.

When you have a location requiring bolted safety enclosures, do away with maintenance trouble by specifying Allen-Bradley trouble free controls. When you have an especially tough job, always use A-B controls. Why not send for the Allen-Bradley Handy Catalog and have full information at your finger tips?

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

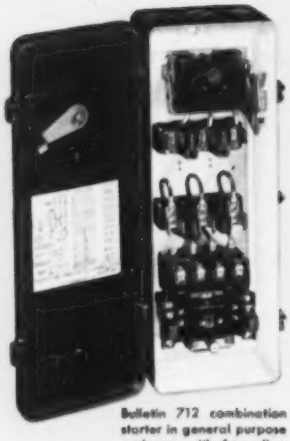
Bulletin 709 magnetic starter with cover removed. Enclosure is NEMA type 4 for watertight operation.

ALLEN-BRADLEY

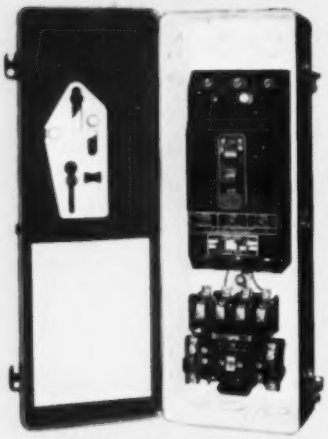
MANUAL AND AUTOMATIC STARTERS

QUALITY

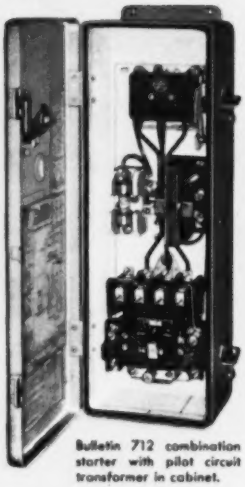
3-52-M



Bulletin 712 combination starter in general purpose enclosure with fuse clips.



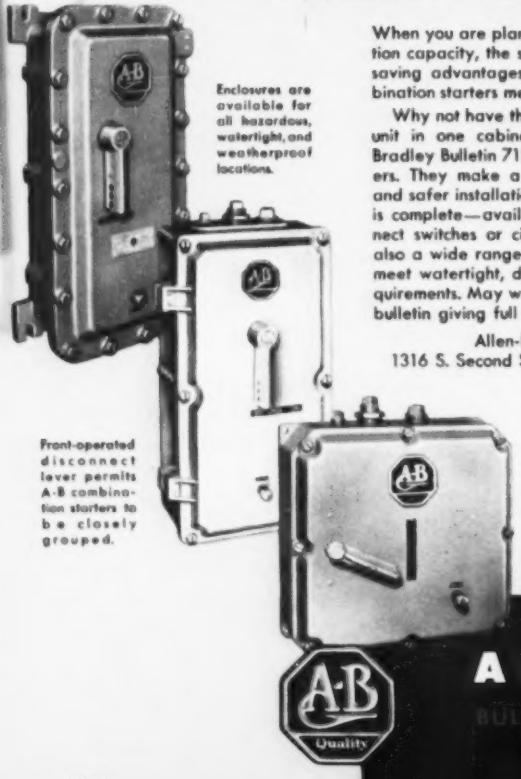
Bulletin 713 combination starter in general purpose enclosure equipped with ITE circuit breaker instead of fused disconnect switch.



Bulletin 712 combination starter with pilot circuit transformer in cabinet.

A GREAT LINE • A COMPLETE LINE

of Combination Starters



Enclosures are available for all hazardous, watertight, and weatherproof locations.

Front-operated disconnect lever permits A-B combination starters to be closely grouped.

When you are planning additional production capacity, the space-saving and labor-saving advantages of Allen-Bradley combination starters merit serious consideration.

Why not have the starter and disconnect unit in one cabinet? Just specify Allen-Bradley Bulletin 712-713 combination starters. They make a neater, more compact, and safer installation. Bulletin 712-713 line is complete—available either with disconnect switches or circuit breakers. There is also a wide range of special enclosures to meet watertight, dust-tight, or gastight requirements. May we send you a descriptive bulletin giving full details and prices?

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

Bulletin 712 combination starter in dust-tight enclosure.

Allen-Bradley starters in safety enclosures require no contact maintenance—a great convenience with bolted enclosures.

The disconnect lever can be padlocked up to 3 locks to prevent accidental switching during machine maintenance.

ALLEN-BRADLEY

BULLETIN 712-713 COMBINATION STARTERS

QUALITY

3-52-M

Day in--Day out DEPENDABILITY...

Year in--Year out ECONOMY...

HAZA... WATERTI... ...ZAPRENE® CONTR... CABLES

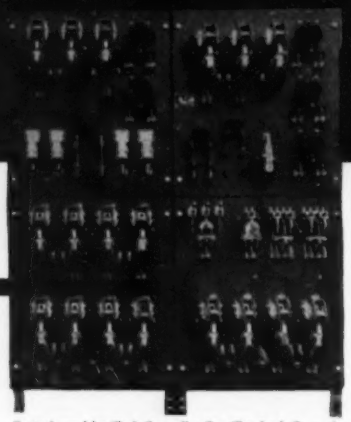
Assurance of day in and day out maintenance-free performance makes Hazard Watertite-Hazaprene cable construction ideal for control circuits. From the inside out – from the corrosion-resistant Hazaloy coated conductors to the rugged Hazaprene sheath – Hazard Watertite-Hazaprene is engineered for long-lived economy.

Watertite-Hazaprene amply meets the exacting requirements of control cable service. Rubber fillers prevent the wicking-in of moisture . . . firm, electrically strong, long-lived Watertite rubber insulation prevents deformation . . . the tire-tough Hazaprene ZBF sheath offers superior resistance to flame, oil, acid, alkali, sunlight, moisture and mechanical damage. The ZBF sheath is a research-developed, service-tested protective covering, compounded of neoprene to Hazard's special Zinc Borate Formula; it is pressure-vulcanized in a continuous lead sheath to give a smooth, dense surface that resists abrasion and tearing.

There's a Watertite-Hazaprene Cable for every control circuit requirement. For further information about these dependable, money-saving control cables, write to Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

This control panel has 3 hidden strengths . . .



Control panel by Clark Controller Co., Cleveland, O., made of K&M Ebonized Asbestos, with arc shields of K&M White Cold-Molded Asbestos.

It's made with K&M EBONIZED ASBESTOS—

Sure, it's handsome, neat, and looks efficient. But you'll find that apart from the satin black finish of the K&M Ebonized Asbestos, this panel's real strengths are hidden. To wit—

1. *IT'S HIGHLY DIELECTRIC . . . for when asbestos fibers and binding cement are molded under pressure and impregnated with a special insulating compound, the result is a non-magnetic product and with an exceptionally high dielectric strength.*

2. *VIBRATION-PROOF . . . your breaker components stay put when they're anchored on K&M Ebonized Asbestos—a material that ignores shock, vibration, and temperature changes.*

3. *ROCK-LIKE STRENGTH . . . your panel is relatively lightweight and compact, but enormously strong because the asbestos and cement of which it is made are practically indestructible.*

You get other advantages, too, with K&M Ebonized Asbestos . . . *it's easy to work*—can be cut and drilled without chipping or fracture—*it's versatile*—comes in $\frac{1}{8}$" to 4" thicknesses suitable for switchboards, bus bar supports, compartment linings, testing tables and the like.

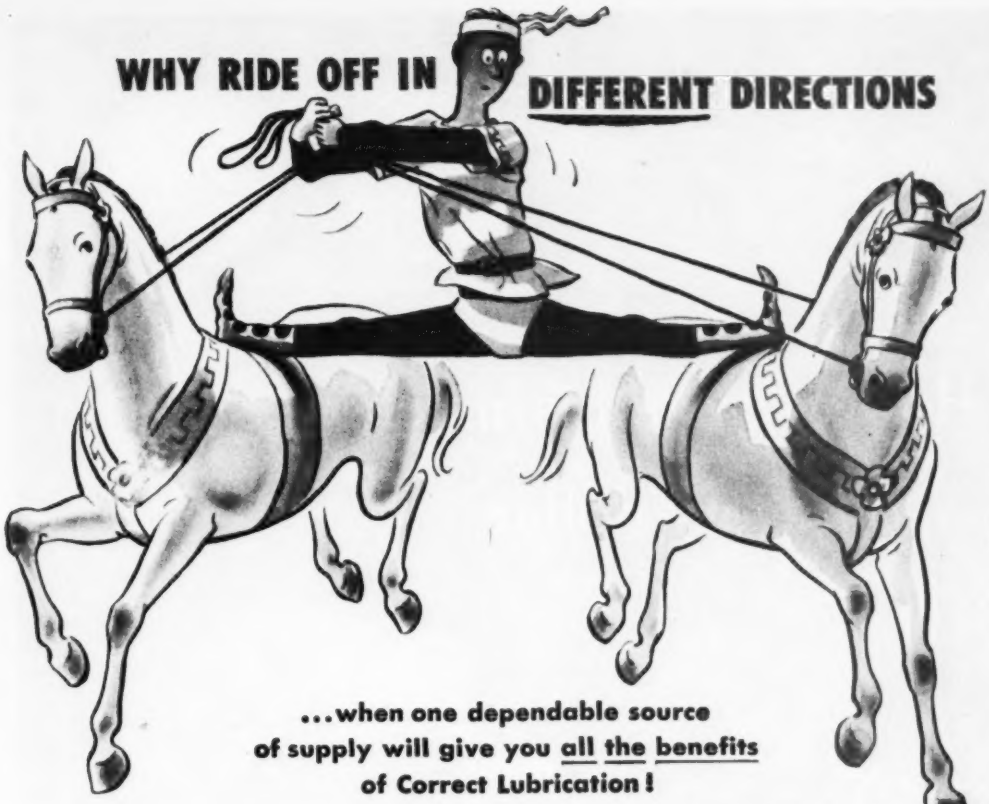
Write us for details on any application—we'll rush a reply.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada: ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER

WHY RIDE OFF IN DIFFERENT DIRECTIONS



...when one dependable source of supply will give you all the benefits of Correct Lubrication!

The questionable benefits of splitting your oil business are far outweighed by the *positive* benefits of buying all your lubricants from one reputable supplier.

For example—your decision to buy from Socony-Vacuum brings you an analysis of your plant lubrication, recommendations to improve lubrication efficiency, continuous engineering service and proof of benefits.

Designed for *your* machines, this program of Correct Lubrication pays off in greater efficiency, less power loss, lower maintenance and over-all lubrication costs.

Why not call your Socony-Vacuum representative *today?*

SOCONY-VACUUM

SOCONY-VACUUM

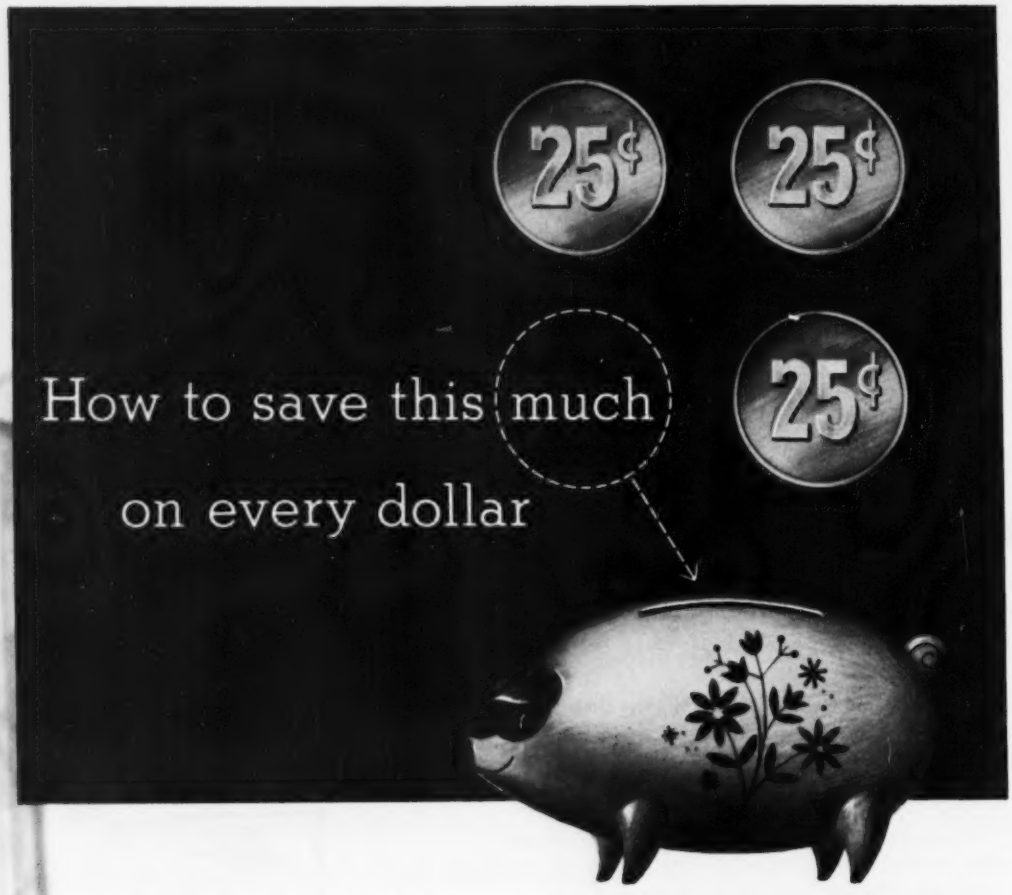
Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

SOCONY-VACUUM OIL COMPANY, INC. and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

The Right Oils for Turbines, Diesels...Every Machine in Your Plant

BACKED BY THE WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE



IF YOU use Kaiser Aluminum Weatherproof Conductor on your next installation you'll save *up to 25%*. Here's why:

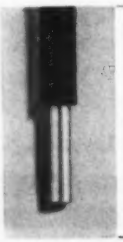
Aluminum conductor costs less than copper, so your initial expense is less.

Aluminum has about half the weight of copper, so handling is easier—faster installations are possible.

And Kaiser Aluminum Weatherproof Conductor's light weight and small diameter assure lower wind- and ice-loadings, lower tensions on house and pole. Neoprene or polyethlene covering resists moisture, abrasion, fungi—will not festoon. So maintenance costs are reduced.

Act now! Give immediate consideration to the savings and advantages of Kaiser Aluminum Weatherproof Conductor for both *service drops* and *secondary distribution lines*. Send for free booklet giving complete engineering data on new Kaiser Aluminum covered conductor—both weatherproof line wire and self-supporting Triplex.

Call or write Kaiser Aluminum offices in principal cities, or our distributors: General Electric Supply Corporation, Westinghouse Electric Supply Company, Line Material Company, Mine Smelter and Supply Company, Tafel Electric and Supply Company, Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.



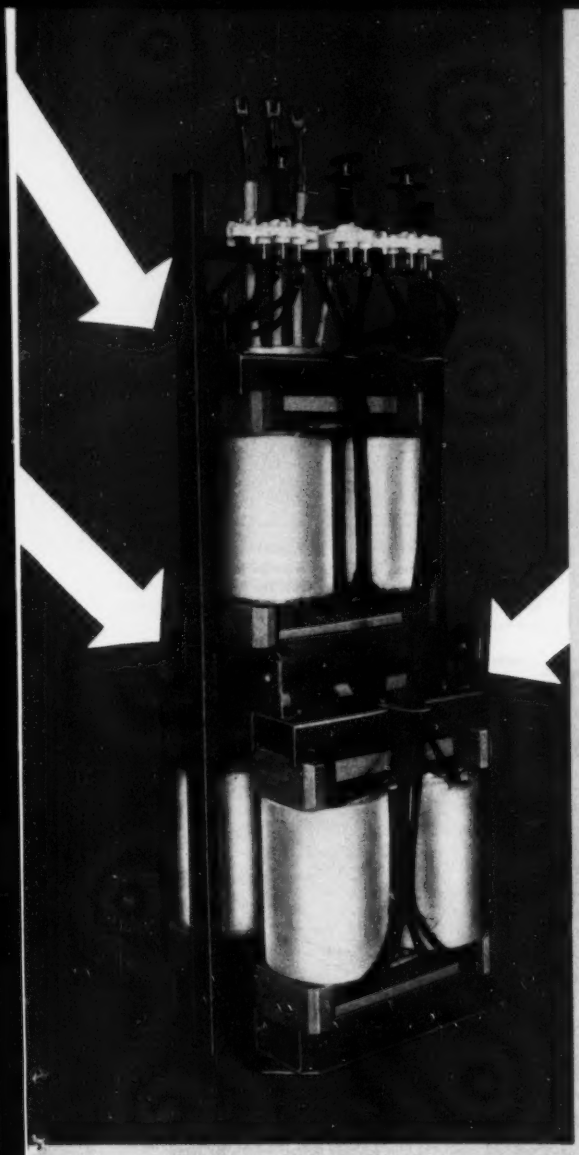
TYPICAL COST SAVING on a 100-ft., 3-wire service

	MEDIUM HARD DRAWN NO. 4 SOLID TRIPLE BRAID COPPER	NEOPRENE-COVERED NO. 4 SOLID ALUMINUM CONDUCTOR
Conductor	$11.14	$ 8.70
3 Split Bolts at Pole .	.75	.84
3 Connectors at House	.21	.36
Cost of Wire Holders .	.81	.81
	$12.91	$10.71

A saving of 17%, **plus** lower installation costs!

Kaiser Aluminum

Setting the pace—through quality and service



Three single-phase core-coil assemblies, one above and two below, for simplified mounting and best cooling. Rigidly held in strong channel-steel frame which fits into steel channels welded inside tank wall.

It's easy to replace any one unit in L-M 3-PHASE ROUND WOUNDS®

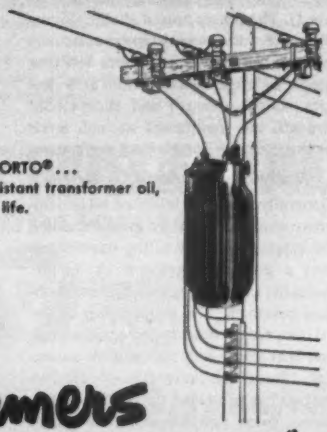
L-M Round-Wound transformers have exceedingly high impulse strength and overload capacity so that burnouts are extremely rare. But if a coil *should* burn out, you don't have to replace the whole transformer. The core-coil assembly from any one phase is simply removed from the rack and a replacement unit quickly installed.

It's as simple as that, and almost as quick . . . whether it's done in your own shops or in one of the authorized L-M Transformer Service Shops near you.

Under emergency conditions you can restore service in a hurry because with L-M construction you can connect two units in open wye or delta.

Besides the advantages of rapid core-coil replacement and fast service restoration, L-M 3-phase transformers give you all the desirable Round-Wound performance features . . . with the wound core that isn't cut or disturbed in any way after annealing . . . with the round coils wound right onto the core. An L-M "exclusive!"

Get the whole story. Ask the L-M Field Engineer or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).



Now furnished with ORTO® . . . L-M's oxidation-resistant transformer oil, inhibited for longer life.

LM®

LINE MATERIAL Transformers

Complete Coordinated Equipment for Distribution Today

LET'S LOOK AT THE FACTS

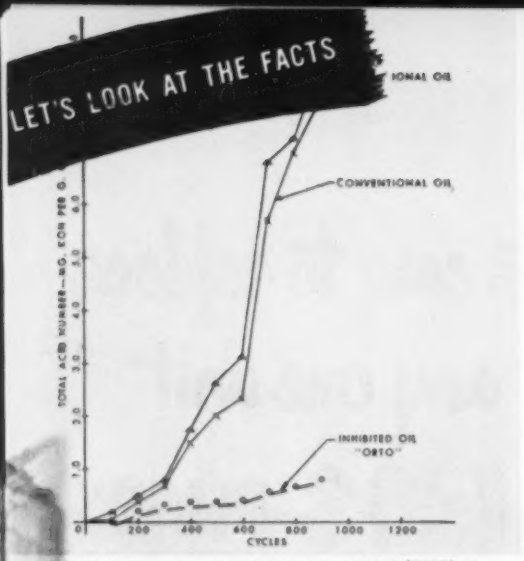


FIGURE 1—Comparison of acids formed by inhibited (ORTO) oil and conventional transformer oils in laboratory tests. Reduction of acid formation increases the life of the oil two to three times, and prolongs the life of the cellulose insulation.

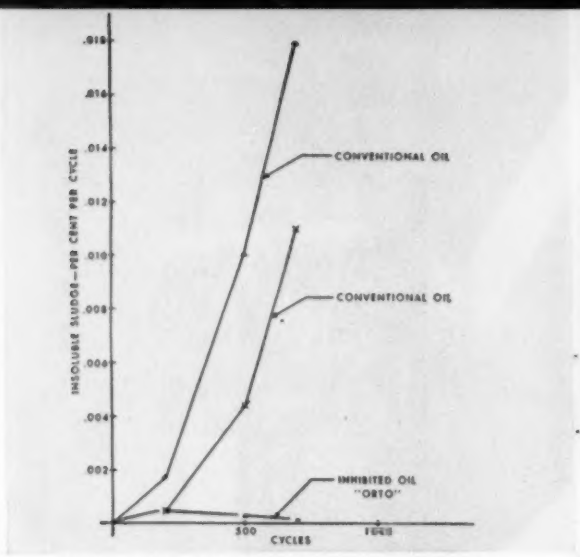


FIGURE 2—Comparison of sludge formation in conventional and inhibited (ORTO) oils in laboratory tests. The prevention of sludge formation appreciably lengthens life of the oil and the transformer, and maintains high overload capacity.

L-M's ORTO® Lengthens Transformer Life and Increases Overload Capacity

by **MARTIN I. ZWELLING,**
Chief Laboratory Engineer,
Transformer Division, Line Material Co.

The life of a transformer is largely determined by the life of the cellulose insulation. This, in turn, is dependent upon temperature of operation, formation of acids, and the length of time these two reactants are in effect.

Obviously the prevention of acid by an inhibitor eliminates one reactant (Figure 1). The prevention of sludge (Figure 2) modifies the other—temperature—by permitting free oil circulation, and thus keeps cellulose deterioration at a low rate. Surge strength and short-circuit strength are maintained at high levels throughout the transformer's life span.

Maintains Overload Capacity

Generally speaking, inhibited oil will improve overload capacity by maintaining the original capacity of the transformer over a greater proportion of its life. Actually, in high magnitude, short duration overloads, the temperature of the oil does not increase to any great degree, and heat affects only the cellulose insulation. But if the prevention of acid formation has protected the cellulose insulation from deterioration, the transformer is better able to handle a high short-time overload without damage.

In the case of long time, low magnitude overloads, the use of an inhibited oil such as ORTO has an even more marked effect. In conventional oils, overload capacity will be decreased as oxidation builds up increasing amounts of acid and blanketing layers of sludge (Figure 3). By preventing the formation of acids and sludge, the transformer maintains its initial high overload capacity for a greater proportion of its life (Figure 4).

Lengthens Transformer Life

If an operator obtains a certain life expectancy from a transformer under certain operating conditions, life will be increased with an inhibited oil under these same operating conditions. Or, with the same operating conditions and the *same life expectancy*, a certain increase in the overload is possible with ORTO.

Long term tests (Figure 5) and short term accelerated tests (Figure 6) have been made which show a marked degree of correlation (Figure 7). These tests indicate that the inhibitor in ORTO greatly prolongs oil life before acid and sludge deterioration commences, and that after this deterioration starts, ORTO follows the same gradual curve of any high grade conventional oil (Figure 8). The inhibitor has no harmful effects, it does not react with any other known inhibitor, and it may be blended with other oils, new or reclaimed, inhibited or non-inhibited. Naturally when ORTO is blended with another oil a certain amount of dilution occurs which reduces the effective life-extension properties of the inhibitor to the extent that ORTO is diluted. The overall effect of ORTO can be safely judged from the diagram.

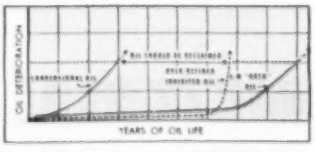


FIGURE 8—Comparative curves show the deterioration in service of a conventional oil, an inhibited over-refined oil, and ORTO brand oil, in which deterioration, when it finally starts, follows the same gradual curve as any high grade conventional oil.

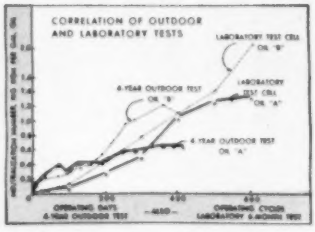

CORRELATION OF OUTDOOR AND LABORATORY TESTS
4-YEAR OUTDOOR TEST OIL "B"
4-YEAR OUTDOOR TEST OIL "A"
OPERATING DAYS 4-YEAR OUTDOOR TEST
OPERATING CYCLES LABORATORY 6-MONTHS TEST

FIGURE 7—Typical curves showing the close correlation between the 4-year outdoor tests and the laboratory tests on two oils. This close correlation prevailed throughout on the various oils tested and in the wide variety of tests made.

FIGURE 3—Laboratory test coil after the equivalent of about 18 years service using a good grade of conventional oil. Notice the heavy sludge deposits, which have clogged oil passages, causing higher temperatures, deterioration of insulation, and lower overload capacity.

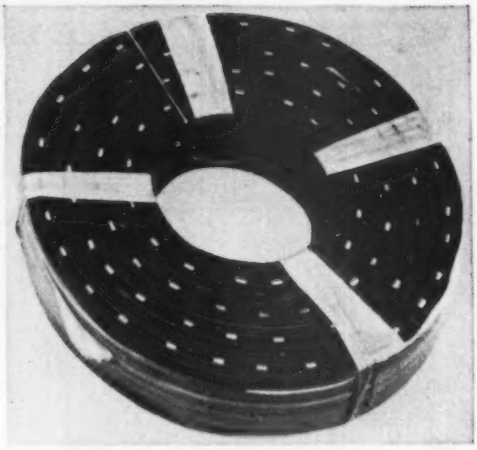


FIGURE 4—Here is an identical coil, after operating for the same period of time under the same conditions except that the oil was ORTO. Acid and sludge formation has been prevented; oil passages are clear; initial overload capacity and impulse strength have been maintained.

FIGURE 5—Outdoor tests started some years ago were used as a basis for developing accelerated laboratory tests. These outdoor tests were closely checked against other long time tests run by oil companies and utility companies, and were correlated with laboratory procedure.

FIGURE 6—Laboratory equipment in which conventional and inhibited oils were tested under closely controlled conditions. The laboratory test permitted precise recording of acid and sludge formation and of deterioration of insulation, wire, and other parts of the transformer.

Look at the facts! Get details on L-M Round-Wound Transformers

L-M Round-Wound transformers consist of a wound core, with round coils wound directly onto the core, which therefore is not cut or unwound, and air gaps are not introduced.

Because of the design and the long, round coils, the transformers offer better regulation, high short time overload capacity, high impulse level and high short circuit strength, low exciting current, and better loss ratios. And they are filled with ORTO, L-M's outstanding Oxidation Resistant Transformer Oil!

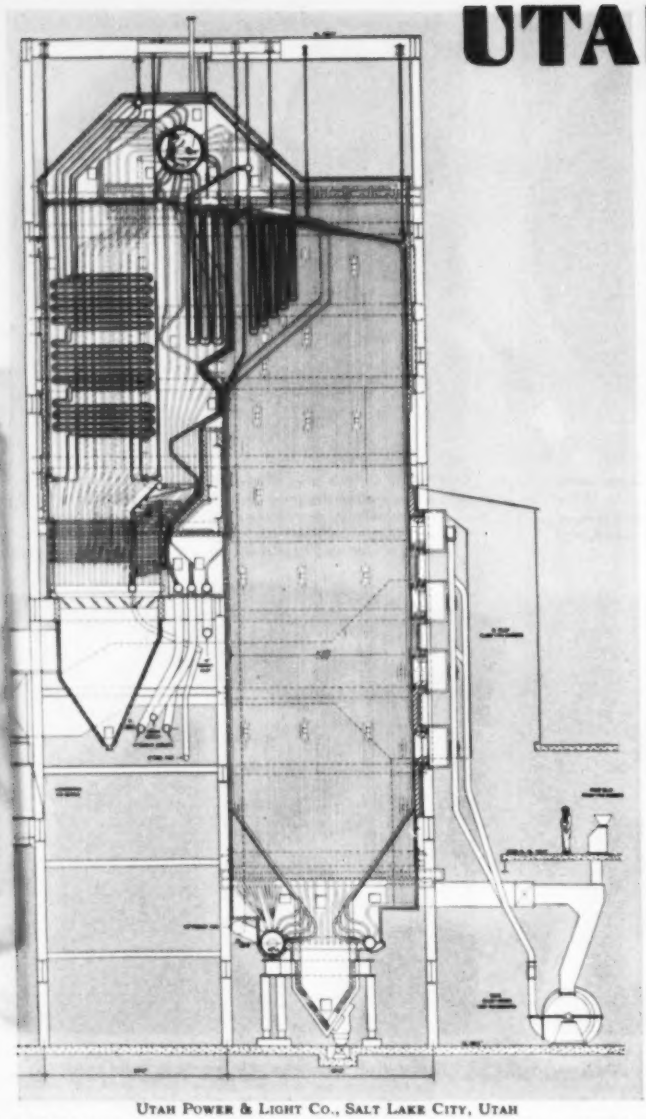
Get the facts from the L-M Field Engineer, or write Mr. Zwelling at the Transformer Division, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).

LINE MATERIAL
Transformers

LM ORTO 85

Complete Coordinated Equipment for Distribution Today

UTAH Goes to



Utah Power and Light Company is installing a 575,000 lbs. per hour 1700 psig 1000°F. Riley unit with 525,000 lbs. per hour reheat at 396 psig and 1000°F. at its Gadsby station at Salt Lake City as unit No. 2. Some of the outstanding features of this unit are mentioned on the following page. Unit No. 1 now in operation is a 620,000 lbs. per hour 1500 psig, 955°F. Riley unit. Unit No. 2 is to be fired with Riley "50" Pulverizers. Unit No. 1 is fired with petroleum pitch but designed for future pulverized coal firing.

At its Hale Station, Utah Power has installed a 450,000 lbs. per hour Riley pulverized coal fired unit and another Riley unit is installed at its subsidiary Western Colorado Power Co., Jim Bullock Plant at Montrose, Colorado.

Engineering Data

Capacity, 575,000 lbs./hr.
Design Pressure, 1,700 psig.
Steam Temperature, 1,000°F.
Reheat Temperature, 1,000°F.
Furnace Volume, 53,000 cu. ft.
Temp. Furnace Exit Gas, 1,900°F.
Furnace Width, 29'3"
Furnace Depth, 23'10⅞"
Efficiency, 87.8%
Fired by 4 Riley "50" Pulverizers and 12 Riley Flare Type Burners

UTAH POWER & LIGHT CO., SALT LAKE CITY, UTAH
575,000 lbs. hr. — 1700 psig, 1000°F. — 525,000 lbs./hr. reheat — 396 psig, 1000°F.
Bechtel Corp., Engineers.

TRADE MARK Rx REGISTERED

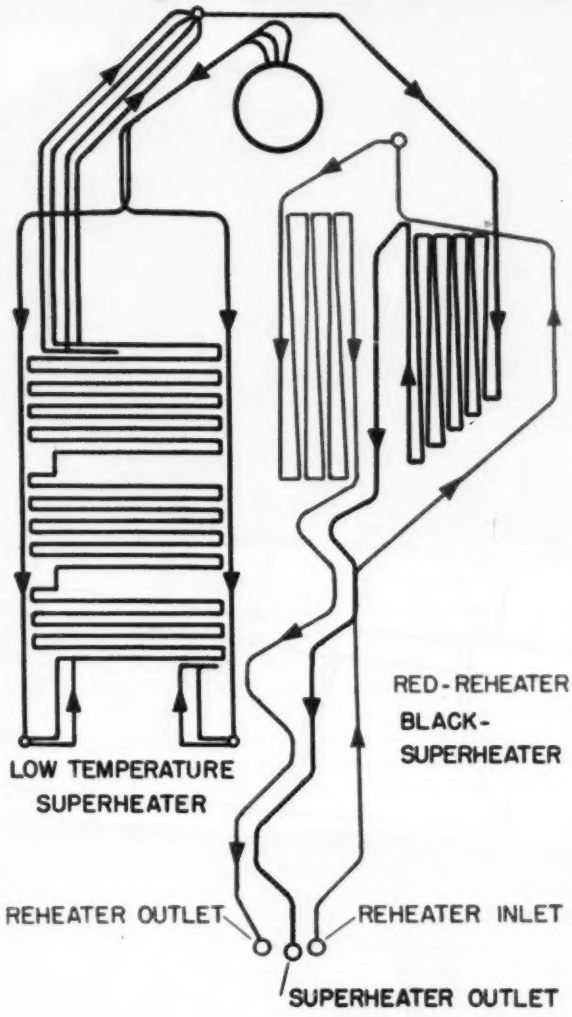
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Charlotte Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · ECONOMIZERS

1700 psig 1000°F and 1000°F Reheat



Reheater Partially Radiant

Due to the large amounts of heat required to give 1000°F. steam temperatures for both superheater and reheater, design features must be incorporated which will give the desired steam temperatures and at the same time permit operation at sufficiently low furnace temperatures to prevent objectionable slagging of furnace and screen tubes.

Riley accomplishes this by making the first section of the reheater of radiant surface as illustrated in the accompanying diagram. With the relatively low reheater inlet temperature and high positive flow velocities the use of radiant surface is definitely warranted. By this design the desired steam temperatures are obtained with entering gas temperatures well below the danger point.

Uniform superheat temperatures over a wide load range are obtained by means of by-pass dampers beyond the economizer. A spray type temperature control is provided for the reheater. The use of four rows of burners also aids in controlling steam temperatures.

All tubes entering the upper and lower drums are welded to stub ends, shop welded into the drum shells. All superheater and economizer tubes are likewise welded to stubs ends welded to the headers. Such construction assures permanent tight connections.

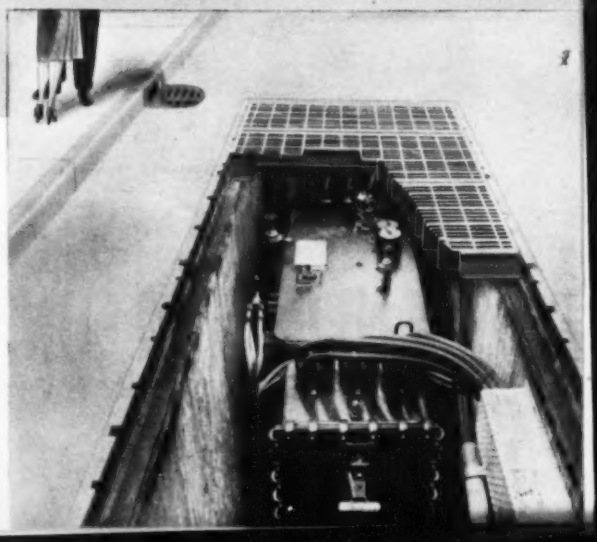
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

The Jamaica network (a portion of which is pictured above) is an outstanding example of the long-run economy of networks in areas of growing load. Established in 1927, this network now consists of 258 transformers serving 120/208-volt secondaries from 27,600-volt feeders. Of the total demand of 64,000 kw, more than 35% developed in the years 1945 through 1949.



For the majority of their installations, Con Edison uses a standardized liquid-filled submersible transformer in a precast concrete vault. Readily accessible when necessary, vaults are out of the way under sidewalks or streets.

Consolidated Edison reports:

Only a Network could expand like this

In Jamaica, a section of Queens Borough, New York City, Con Edison experienced recurring load "growing pains" for years. Then in a boom of commercial remodeling, demand shot up; the problems could have become acute. In one city block, revamping and air conditioning a department store boosted demand from 570 to over 2,100 kw within three years.

But Consolidated Edison had foreseen the possibilities; had a network well established.

"The expansion was comparatively simple," they report. "No service interruption. No overtime rush. Existing facilities handled the load until new installations could be completed."

Similar situations arise continually. "Even in some suburbs," they find, "where load growth is a reasonable certainty, networks offer long-run economy."

Reliability and flexibility are the characteristics that make the change-over to network systems pay in areas where loads are growing. By practically eliminating outages, they experience fewer emergencies, avoid overtime repairs. Load problems are handled easily. And there's another all-important advantage: the value of outages avoided in dollars and in customer good will.

The reliability of modern network transformers is a vital factor in the success of any network installation. Networks make severe demands on transformer performance, particularly when secondary faults must burn clear, and when emergency overloads are carried to maintain service.

Westinghouse Engineers, working in conjunction with electric power companies, pioneered network installations and the transformers they require. Today, Westinghouse Transformers meet highest standards with features that assure trouble-free service. For specific information, ask your Westinghouse Representative for booklet B-4082A, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70627

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK TRANSFORMERS

A "NATURAL" *for* ALUMINUM CABLE

If your plans call for the installation of aluminum cables on the basis of copper size, we would like to suggest that you consider the following point. Aluminum will heat to a greater extent than copper when the same amount of current is put through the cable.

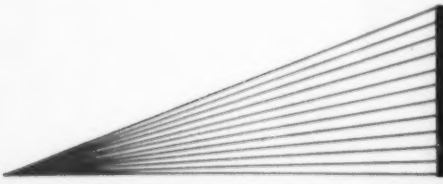
So instead of using conventional insulations, which are seldom rated more than 140 F. (60 C.), specify Simplex-Anhydrex XX insulation. This will help overcome the heat problem because Anhydrex XX is rated at 176 F. (80 C.).

Simplex - Anhydrex XX insulation will operate at temperatures up to 176 F. (80 C.) in either wet or dry locations at voltages up to 17,000.

If you must use aluminum because of the copper shortage, let our engineers help you with your problem.

We would be more than happy to give you the latest specification data on Simplex-Anhydrex XX insulation. Simply send your request to the address shown below.

Simplex-Anhydrex XX is a product of Simplex Research.



SIMPLEX-ANHYDREX XX

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

LARGE SOUTHEASTERN SYSTEM *reports:*

FROM ITS C-D CAPACITORS

Called upon to supply enormous quantities of power to vital government plants, this utility is extremely "power-factor conscious." To date, C-D capacitors have delivered over 500 million Kvar hours of trouble-free service for this utility, under the most severe operating conditions! This outstanding field performance record is typical of more than 4,000 C-D power-factor installations made in the past decade.

a real test for capacitor dependability!

C-D installation shown is at the Southern Ferro Alloys plant. The large open type furnace (in background) runs well over 3000° F. This, plus the summer sun, corrosive fumes, etc. is a most severe test of the capacitor installation's ruggedness.

A C-D engineer will be glad to point out the many dollar-saving characteristics of C-D capacitors. CORNELL-DUBILIER ELECTRIC CORP. DEPARTMENT D 63-A SOUTH PLAINFIELD, N. J.

CONSISTENTLY DEPENDABLE

CORNELL-DUBILIER CAPACITORS

PLANTS IN: SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER, CAMBRIDGE, MASS.; PROVIDENCE, R. I.; INDIANAPOLIS, IND.; FUQUAY SPRINGS, N. C. AND SUBSIDIARY: THE RADIANT CORP., CLEVELAND, OHIO

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD
JENNISON
CECIL LYNCH
HAVANA
MEREDOSIA
PERMIAN BASIN
O. H. HUTCHINGS
REX BROWN
HICKLING
B. C. COBB
RUSSELL
SEWAREN
POSSUM POINT
PORT JEFFERSON
CUTLER
WHITE RIVER
GADSDEN
POTOMAC RIVER
W. SPRINGFIELD
WOOD RIVER
LAKE CATHERINE
HARRY NEWMAN
DAN RIVER
JIM HILL
HUTCHINSON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER

BECKJORD

STATION X
BLACK DOG
MERAMEC
ALBANY
LAWRENCE
HENNEPIN
URQUHART
EASTLAKE
OAK CREEK
ETIWANDA
AURORA
JOPPA
RIVERSIDE
KINGSTON
BARRY
SUWANNEE RIVER
NELSON
LAKE CREEK

New goes into

Nicely timed to add new capacity for rapidly growing load requirements is the new Walter C. Beckjord Station of The Cincinnati Gas & Electric Company at New Richmond, Ohio. The first unit, recently placed in service, adds 100,000 kw to the present system capacity of 560,000 kw. The 1951 peak load was 558,800 kw.

Presently the Cincinnati Gas & Electric system is serving about 350,000 customers with power and light and is, of course, tied in with the greater power network of the Mid-West.

The Beckjord station is located on the Ohio River about 18 miles east of Cincinnati, ideally situated to serve the unprecedented industrial and population growth which has come to this area. Sargent & Lundy of Chicago are the Consulting Engineers.

The 100,000 kw turbine-generator is served by a C-E Steam Generating Unit of the reheat type, a cross-sectional elevation and brief description of which appears on the opposite page. A duplicate unit—turbine-generator and boiler—is now in process of fabrication and is scheduled for service in 1953.

B-580

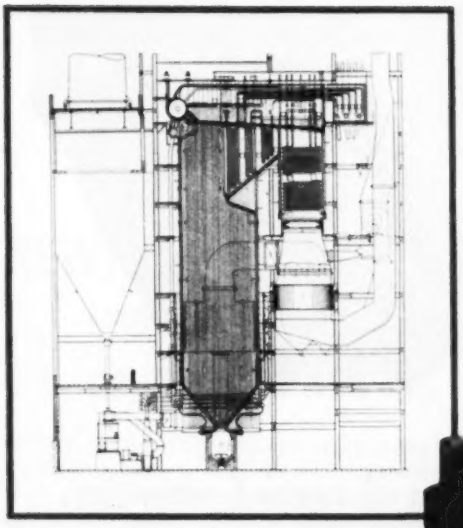
C-E

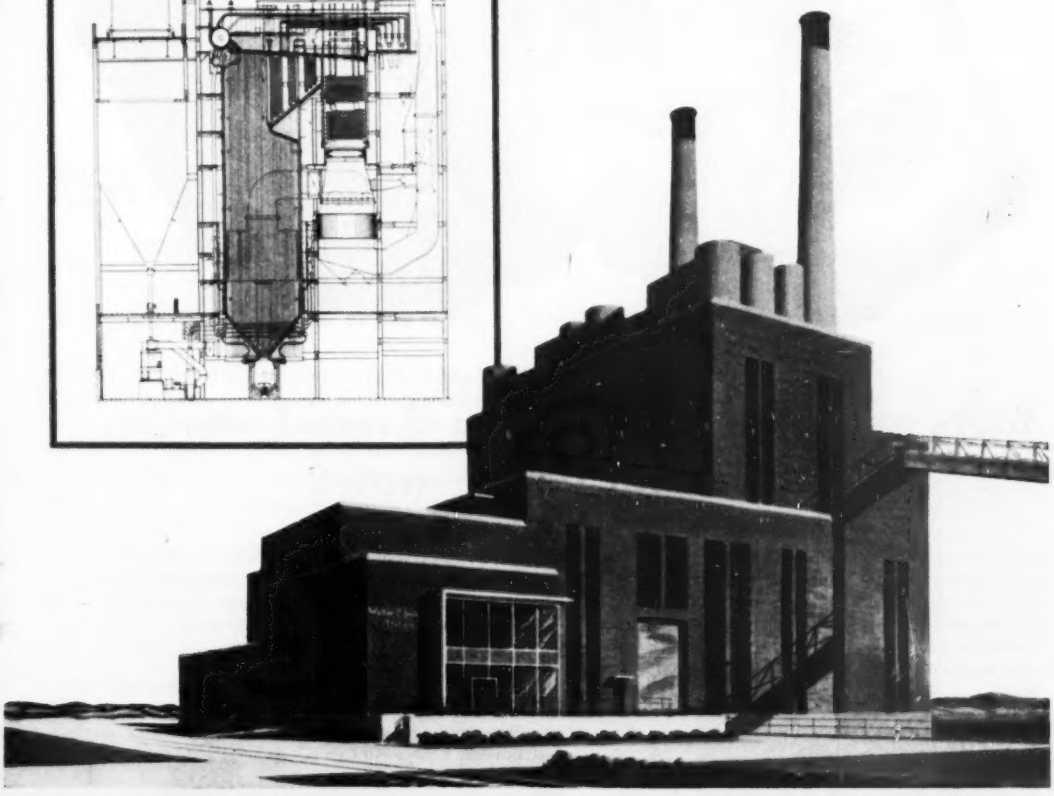
COMBUSTION

200 MADISON AVENUE, NEW YORK 16, N. Y.

Beckjord Station service

The cross-sectional elevation at the left shows one of two duplicate C-E Units for the Walter C. Beckjord Station. They are reheat units of the radiant type with a reheater section located between the primary and secondary superheater surfaces. A finned tube economizer is located below the rear superheater section and regenerative type air heaters follow the economizer surface. These units are pulverized coal fired using bowl mills and tilting, tangential burners. Steam is supplied to the turbines at 1450 psi with a primary temperature of 1000 F, reheated to 1000 F.





ENGINEERING—SUPERHEATER, INC.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

You're paying for an ideal system of record retention ...why not get it—now?

Every record properly filed and continuously under control . . . every record systematically classified and safely stored for the period of time serving your own needs and all legal requirements . . . every record preserved and indexed in the form that's most convenient and economical for you . . . all this you're *paying* for right now in one way or another. But do you actually *have* such a system for well planned, efficient Record Retention?

Free Booklet Gives You a Yardstick of Performance

A wealth of practical ideas accumulated by Remington Rand in years of business systems leadership, is available to help you solve Record Retention problems. Much of this experience is condensed in our new, 24-page booklet, "A Basic Plan . . ." telling how to save on clerical time, filing space and equipment . . . how to organize a retention plan and follow it through successfully . . . how to evaluate records in terms of fire and other types of protection . . . and how your complete changeover can be made to a new, ideal system without burdening your office staff with extra work.* For a free copy—and there's no obligation—visit our nearest Business Equipment Center or write to Management Controls Reference Library, Room 1172, 315 Fourth Avenue, New York 10.

*You can "rent" experienced supervisors and/or complete office staffs from our Business Services Departments for record reorganization and other peak load assignments, including punched-card accounting and microfilming.

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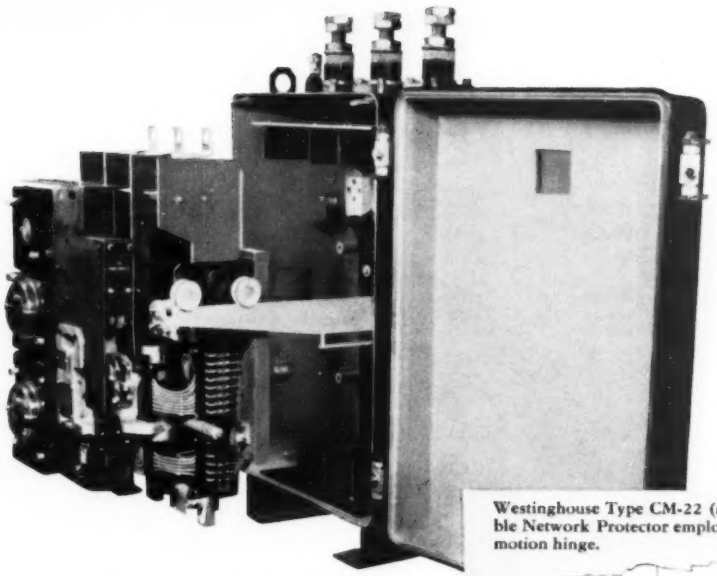


Westinghouse Type CM-22 (above) submersible Network Protector employs the new dual-motion hinge.

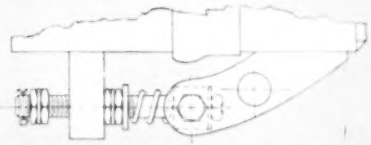
NEW, dual-motion hinge

SIMPLIFIES CLOSING OF NETWORK HOUSING

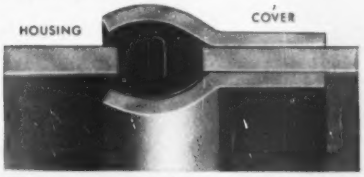
Now, the exclusive Westinghouse quick-opening, submersible Network Protector housing—which eliminated 26 to 44 bolts—has been further improved to simplify the operator's job. A new dual-motion hinge permits the cover to ride forward before it is swung open. This action relieves gasket pressure . . . leaves no restraining force to work against when closing the cover.

Your operators will like the simplicity and convenience of this Westinghouse "plus," as well as other housing features such as captive hardware, factory-adjusted stop nuts, and provision for hinging on either side. You'll like many additional, exclusive features built into all Network Protectors. For complete information, contact your Westinghouse Representative or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

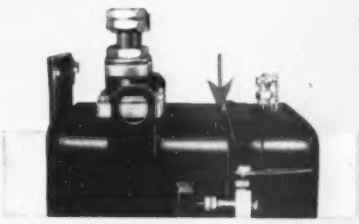
J-60790



Dual-motion hinge detail. Factory adjustment for centering cover is independent of adjustment for gasket deflection.



Tubular Neoprene gasket compressed between machined edges on housing and cover provides a tight seal.



Top of network housing showing uniform gap between housing and gasket before tightening cover. This prevents the hinge side of the cover from "rolling" the gasket.

YOU CAN BE SURE . . . IF IT'S

Westinghouse

NETWORK PROTECTORS

NETWORK SYSTEMS PAY... IN *NEW JERSEY!*

Newark, Underground Network

Clifton, Underground and Overhead

East Orange, Underground Network

Princeton, Underground Network

Trenton, Underground Network

Teaneck, Underground Network

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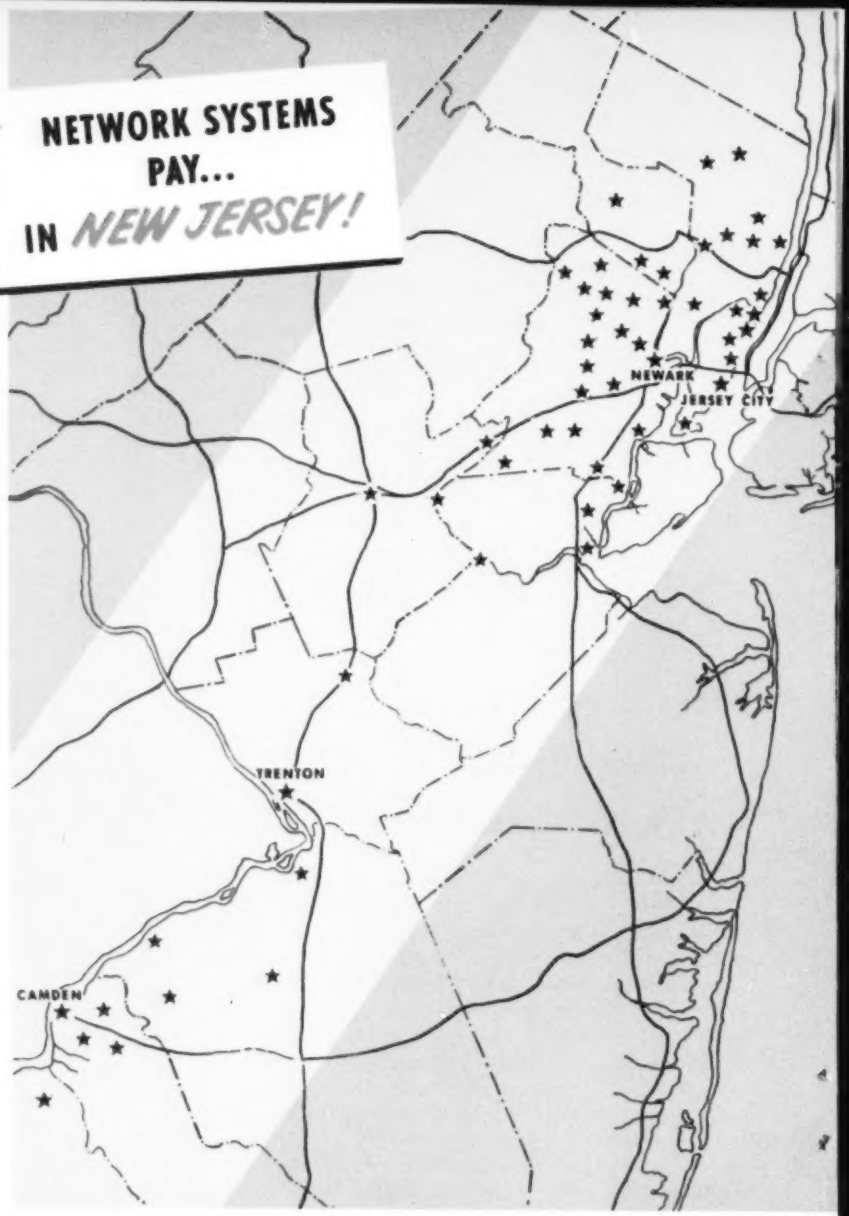
Moorestown, Underground Network



Advance Planning at its BEST!

Most interesting fact about this largest single utility group of networks is the unmistakable evidence that farsighted planning paid! For this alert utility took bold preventive action more than 20 years ago. And when peak loads had doubled, Public Service Electric & Gas Company of New Jersey was really ready!

Public Service serves 1,234,287 consumers in progressive and fast-growing New Jersey. It was among the first to recognize the long-range merits of the A-C Secondary Network System. Beginning in 1928, with its first network in Newark, Public Service had 5 in operation by 1930. By 1940, the number of networks had swelled to 90. Today this utility has a total of 94 networks . . . underground, overhead, and spot . . . serving a wide variety of load requirements in fifty-six communities . . . ranging in size from 4,189 to 438,776 . . . throughout this important industrial belt. The views on these pages show typical communities so served.

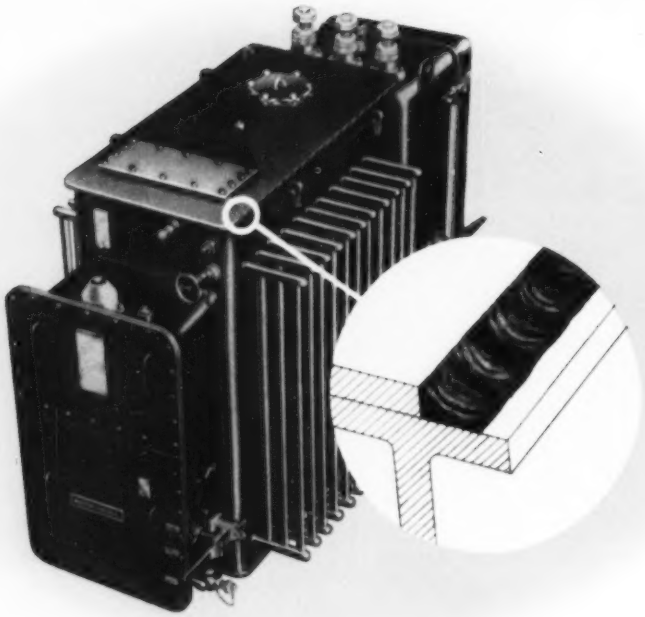
Because of intelligent advance planning, the tremendous expansion of the war and postwar years, which practically doubled peak loads throughout this network area, presented no problems! The unusual flexibility of the A-C Secondary Network System enabled Public Service to offer high standards of service continuity to small communities as well as large ones. The Network System can provide unusually high service continuity for your customers and reduce power distribution costs too! Investigate all of the economic advantages of the A-C Secondary Network System . . . now is the time to prepare for tomorrow's expanding loads. Call or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-97159

Westfield, Underground Network

Our Lady of Lourdes Hospital, Camden, Underground Spot Network

YOU CAN BE SURE...IF IT'S Westinghouse

NETWORK EQUIPMENT



NO COVER BOLTS! NO GASKET!

Another Maintenance Problem Reduced!

It's a major maintenance problem when oil sludges and insulation oxidizes.

Leakage of air and moisture is most likely to occur through the main cover gasket. That's why Westinghouse recommends welded-on covers for network transformers. Leaks are prevented . . . uncontrolled breathing eliminated.

It is still necessary, however, to gasket some switch and terminal chamber covers, bushings, oil gauges and handhole covers. Cortite* gaskets, composed of cork particles individually surrounded and bonded in special synthetic material, have been developed for this purpose. They provide a long-lasting, seepage-proof seal.

These two features, welded-on covers and improved gasketing for small openings, serve to greatly lessen the possibility of oil sludging and oxidation of insulation.

Removal and replacement of welded covers, if necessary, is easier and quicker than the gasket-and-bolt technique. For proof, ask your Westinghouse representative to arrange a showing of the ten-minute movie, "Welded-on". All operating and maintenance supervisors should see it. Phone today or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK TRANSFORMERS

*Trademark

J-70622

Approved by UNDERWRITERS LABORATORIES

YES, the PENN-UNION Connector TAKES THEM ALL-

LARGER SURFACES for the WRENCHES ~ a good-sized HEX Top and Bottom

The men who use connectors appreciate the *better design* of the Penn-Union - - especially when they have to make a splice in close quarters, or any unhandy location.

Better Design is a feature of the entire Penn-Union line, which includes Tees and Taps, Straight Connectors, Terminals, Grounding Clamps, and many more fittings . . . every one thoroughly dependable, mechanically and electrically. *Preferred by leading users,* who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

Far More in use than any other

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

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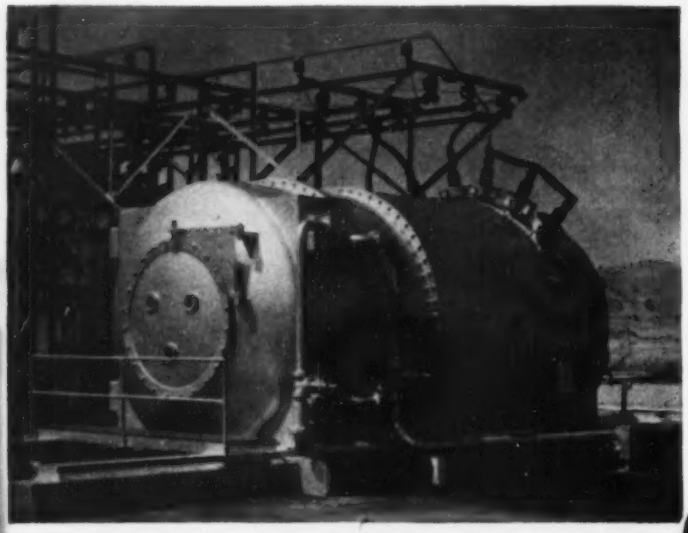
The Complete Line of Conductor Fittings

PENN-UNION

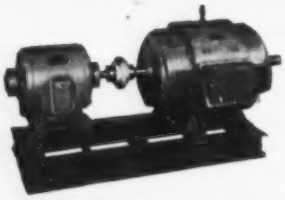
Synchronous Condensers do a GOOD JOB

BETTER with REGULEX CONTROL

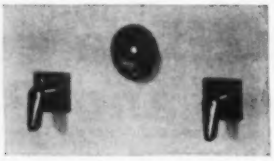


WHEN REGULEX regulators guard synchronous condensers from excessive overload and pole slipping, they assure the best possible job of line voltage regulation. That's why this 40,000/16,800 kva condenser, supplying reactive kva to stabilize a long transmission line, is equipped with *Regulex* control. Even under adverse conditions it's kept on the line . . . automatically supplying the maximum safe amount of corrective kva. A-3676

Regulex Control is Accurate . . . Simple to Adjust and Maintain



THE MOTOR-DRIVEN *Regulex* exciter is conservatively rated for long life. Since it's similar in construction to a dc generator, the same periodic inspection routine can be followed. No special training of maintenance personnel is required.



ONLY THREE operating controls needed: (1) a control switch places regulator in and out of service; (2) a second switch controls the motor-operated main exciter field rheostat; (3) a voltage adjusting device selects proper ac regulated voltage.

COMPONENTS of the *Regulex* voltage regulator in this cabinet have no moving parts, require no maintenance or adjustment after installation. This single control cubicle can be placed in any convenient spot or combined with switchgear equipment.

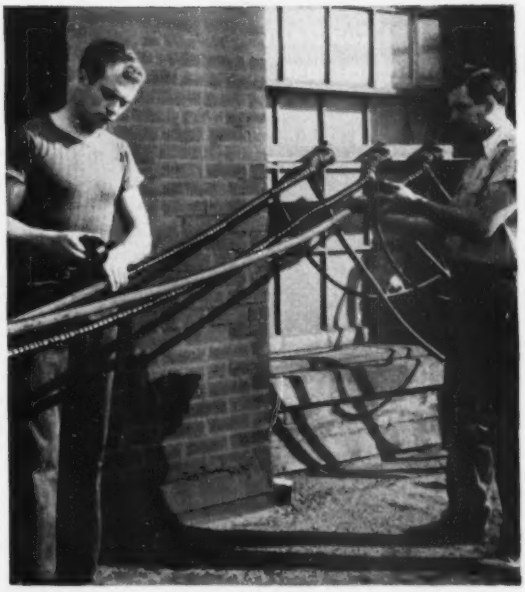
★ **You can use Regulex voltage regulators on alternators, synchronous condensers, and large synchronous motors. In every application, Regulex control gives fast response, provides accurate, sensitive voltage control. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.**

Regulex is an Allis-Chalmers trademark.

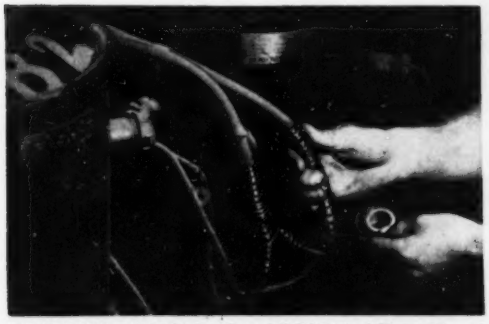
A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Plastic Tape saves $15,000 on worn cables!



See those two men wrapping worn cable insulation with "Scotch" Electrical Tape No. 22? They're saving $5,000 in new cables plus $10,000 in factory shut-down time at a large manufacturing company in New England. Here's why this remarkable tape is so ideal for the job . . .



IDEAL INSIDE AND OUT! "Scotch" Electrical Tape No. 22 has excellent resistance to sunlight, rain, sleet and snow—it never dries out. And it's *thin* (only .010 inch thick) for trim interior wiring, yet it has a dielectric strength of over 10,000 volts. Carries the UL Seal.

FOR GENERAL PURPOSE USE where extra heavy-duty outdoor weather protection is not required, try "Scotch" No. 33 Electrical Tape. It's available in many widths and lengths including the popular "Job Size" rolls—¾ in. x 20 ft. packed 12 to a screw-top container.

FREE BOOKLET! 24 pages crammed with facts on the many "Scotch" Electrical Tapes. Tensile strengths, types of backings, corrosion factors, dielectric strengths—everything you need to know. See how others save! Send for your free copy right away. You'll get immediate attention.

The term "Scotch" and the plaid design are registered trademarks for the more than 200 pressure-sensitive adhesive tapes made in U.S.A. by **Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 270 Park Avenue, New York 17, N. Y. In Canada: London, Ont., Can.

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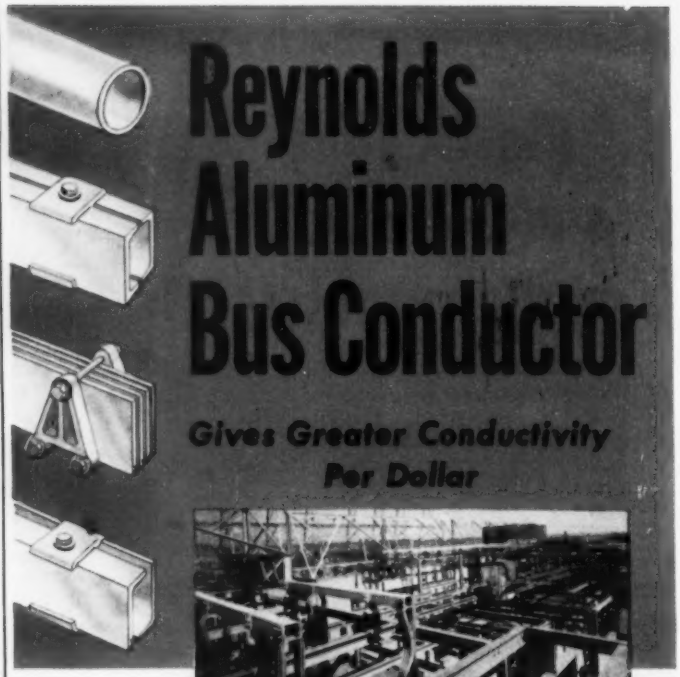
Electrical Applications of Aluminum

Aluminum Cable Steel Reinforced

Worthwhile savings are yours with Reynolds ACSR because the initial price of this steel reinforced aluminum cable is less and you save through reduced handling and field costs. For example, men and equipment are handling 20% less weight with Reynolds ACSR. Easier, faster stringing is bound to result. ACSR is light yet strong—you can go to longer distances between poles—save up to four poles per mile. Or, because there is less sag to ACSR—you can use shorter poles or towers. Reynolds offers engineers a free ACSR manual with full information on line design and erection . . . sag-tension charts, staking tables, stringing-sag tables, etc. Please request on your business letterhead.

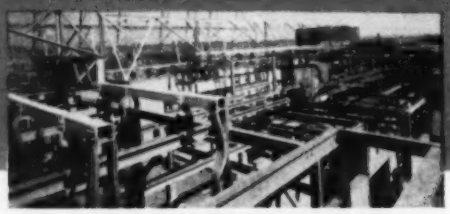
Master Reel and Coil Service

Reynolds offers a Master Reel and Coil Service that goes hand-in-hand with Reynolds ACSR toward saving important time, money and labor. Reynolds all metal Master Reels sharply decrease handling, storage and bookkeeping costs. Four Master Reels actually take the place of one hundred wooden reels. They're easily taken apart and re-assembled around the Master Coil by linemen in the field. Reynolds Master Coils hold the same amount of conductor as conventional wooden reels. They're carefully waterproofed, lagged and banded for complete protection in transit and on the job. For further details, write Reynolds Metals Company or see one of these Reynolds distributors: Westinghouse Electric Supply Co., New York, New York (And branches) • Griffin Manufacturing Co., Dallas, Texas • Williamson Sales Co., Shreveport, Louisiana (And branches) • Hughes Electric Supply, Orlando, Fla. • Maydwell & Hartzell, Inc., San Francisco, Calif. • Power Line Equipment Co., Wichita, Kans.



Reynolds Aluminum Bus Conductor

Gives Greater Conductivity Per Dollar



6 inch square extruded aluminum tubing used for 13 kv, 4,000 ampere conductor in generating station.

Bus conductor made of Reynolds Aluminum costs less than conductor made of other metals—gives you *more* conductivity per dollar. Aluminum bus conductor assures other economies, too, because its lighter weight permits greater span lengths, reduces floor loads, allows faster, easier handling and saves on erection time and labor costs.

Aluminum bus conductor in form of rectangular bars, channels, angles, special extruded shapes and tubing is finding widespread application in utility generating plants and substations, in industrial installations and packaged power control and distribution units. For most uses, past technical problems have all been solved. So, before you plan your next job, consider these characteristics of aluminum: lower cost, high electrical conductivity, light weight with high strength, excellent resistance to corrosion, ease of fabrication, plus other factors favorable to individual applications.

Sooner or later you'll use aluminum—why not now? Start by sending for a copy of AIEE conference paper, Drawn and Extruded Aluminum Products in Relation to the Electrical Industry. For design assistance on your specific applications call on Reynolds Aluminum technical specialists. *Reynolds Metals Company, 2584 South Third Street, Louisville 1, Kentucky.*

Remember—Reynolds technical assistance is always available.

REYNOLDS METALS

REYNOLDS ALUMINUM

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NEW

450-470 Mc.

2-Way Radio Communication Equipment for New Public Safety, Land Transportation, Industrial, and Citizen Bands

Another Best-Choice for You

With the famous Sensicon circuit and Permakay selectivity sealed unit

2-WAY RADIO

BROUGHT TO FULL SUCCESS BY

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WORLD LEADERS IN 2-WAY RADIO

Now you can have all the advantages of uncongested non-interference operation up in the 450 megacycle range . . .

. . . for F.C.C. has given you the space, and Motorola has built for you the quality tool for best results. It is now released for sale to you after more than 2 years of rigorous testing and service in the field.

Here, once again, Motorola has put your best long-term *value* ahead of everything. It will save you up to 25% in maintenance alone.

This completely new design has the same guaranteed, obsolescence-free features that make Motorola equipment *all-ways* your best buy!

—the one others always try to copy

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PLEASE DISPATCH LITERATURE AND HAVE YOUR ENGINEERS CONTACT.

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(Company).....

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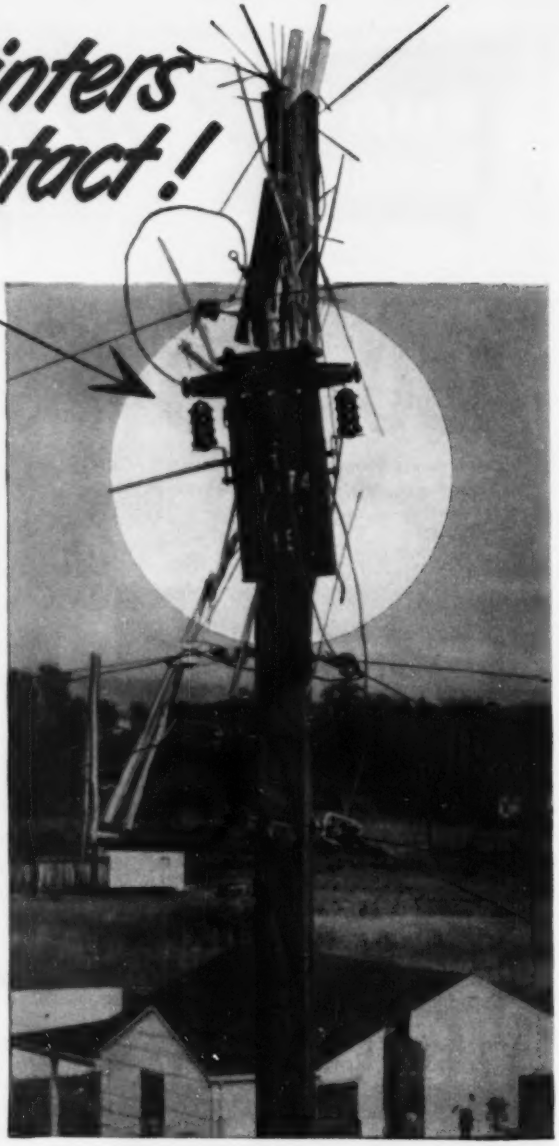
City.....State.....

Pole in splinters ... service intact!



On Loretto Heights Hill, near Englewood, on the Colorado Central Power Company system, this Westinghouse "CSP®" Distribution Transformer took a direct stroke of lightning early in the evening, yet maintained service with no interruption throughout the night!

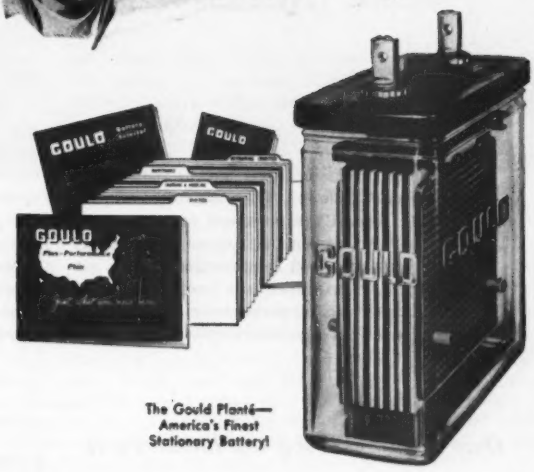
The following day, when a new pole was installed, the transformer was found to be completely unharmed, although the ground lead from the tank discharge gap was burned off. The unit was therefore again hooked up for service.

Westinghouse "CSP" (Completely Self-Protecting) Transformers, because *all* parts are factory co-ordinated, provide better protection against lightning, surges, short circuits, and overloads, giving assurance of service continuity. Your Westinghouse Representative will be glad to show you actual figures which explain why Westinghouse "CSP" Transformers offer bigger savings in installation and maintenance costs. Call him today. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70616-A

"CSP" devices . . . originated and patented by Westinghouse

YOU CAN BE SURE... IF IT'S
Westinghouse
"CSP" DISTRIBUTION TRANSFORMERS

It's just good business to pay a few dollars more and get extra years of service in return. That's why it's good business to specify Gould Planté. The per annum cost of these pure lead batteries is less than any other battery on the market! With the Gould Plus-Performance Plan to help, you'll get truly amazing service life from these "Aristocrats of Stationary Batteries." Write Gould Battery Information Headquarters for full details.



The Gould Planté—
America's Finest
Stationary Battery!

GOULD *Industrial Batteries*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

Sangamo J Meters

make friends of power company customers

Outdoor metering has brought about a big improvement in company-consumer relations. It has eliminated annoyance to the consumer and has reduced expense for the power company.

Outdoor metering is no problem with Sangamo J Meters. They are fully compensated for all temperature extremes and accurately measure all power delivered at sub-zero or torrid temperatures. They are designed to maintain the proper physical relationships of all parts under all conditions of changing temperatures and vibration.

J Meters are quiet in operation even under the most adverse conditions.

J Meters are accurate. Not one case has been reported of a Sangamo J Meter speeding up in service due to loss in damping strength. Since the damping magnets control the speed of the meter, accuracy depends upon the permanence of their strength. Because the alnico damping magnets, used in J Meters, are unaffected by extreme operating conditions, they completely eliminate over-registration with resultant "high bill" complaints.

Only Measured Facts are Known Facts

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SM52-7

Sangamo J Meters have proved their ability to meet today's requirements and tomorrow's anticipated loads with sustained accuracy, economy of maintenance and troublefree performance.

Cable insulating (oil breaker), protected by carbon black (tapes), remains relatively free of oxidation products after oven-aging tests.

"LIVE" INSULATING OIL

Heat and electrical stress produce deterioration products which eventually sign the death warrant for insulating oil. Carbon black may be said to keep such oil "alive." It minimizes and removes deterioration products and keeps them outside the field of the dielectric. It continually purifies and stabilizes the oil . . . keeps it *clean*.

Only ANACONDA Type CB* Power Cable utilizes this phenomenon. Result: greater stability and longer life. This tested paper cable may be obtained with special carbon black binder which adds resiliency, yet possesses adequate strength. A further improvement, F-3** Alloy-Lead Sheath, *triples* sheath life by its high resistance to slow-bending fatigue, creep, burst and abrasion. It won't age-harden.

If you're not using Type CB Power Cable, you aren't getting as much service out of your paper cables as you should. We suggest you get the full story from your nearest Anaconda Sales Office. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 5847T

the right cable for the job ANACONDA® wire and cable

*CB—Carbon Black (U. S. Patents 2,102,129, 2,405,863) Reg. U. S. Pat. Off.

**F-3—Arsenic-Lead Alloy (U. S. Patents 2,506,755, 2,575,756, 2,504,600 and 2,570,503) Reg. U. S. Pat. Off.

CROUSE-HINDS

Explosion-Proof
LIGHTING FIXTURES

Hazardous areas in this plant are lighted by Crouse-Hinds EV Series Explosion-Proof and Raintight Lighting Fixtures

. . . EXCEED the requirements for service in highly explosive atmospheres

To be safe for use in such locations, the fixture must operate at a temperature below the ignition temperature of the gas-air or vapor-air mixture. Also, the fixture must be so strong that it will resist internal explosions without damage and so tight that it will prevent the escape of flames or burning gases which might ignite the surrounding atmosphere.

Crouse-Hinds EV Series explosion-proof and raintight industrial lighting fixtures meet all of these requirements PLUS a wide margin of safety for extra protection.

Complete listings are in Crouse-Hinds Condulet Catalog.

Crouse-Hinds offers a complete line of explosion-proof and dust-tight lighting fixtures for use in hazar dous locations where fluorescent lamps are desired.

Type EVF 1, 2, 3, or 4-lamp

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Syracuse 1, N. Y.

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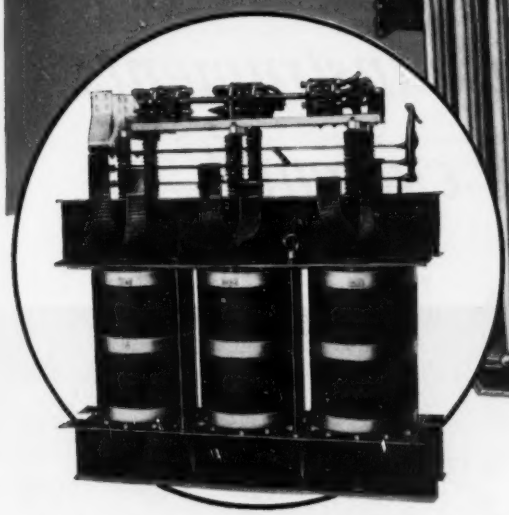
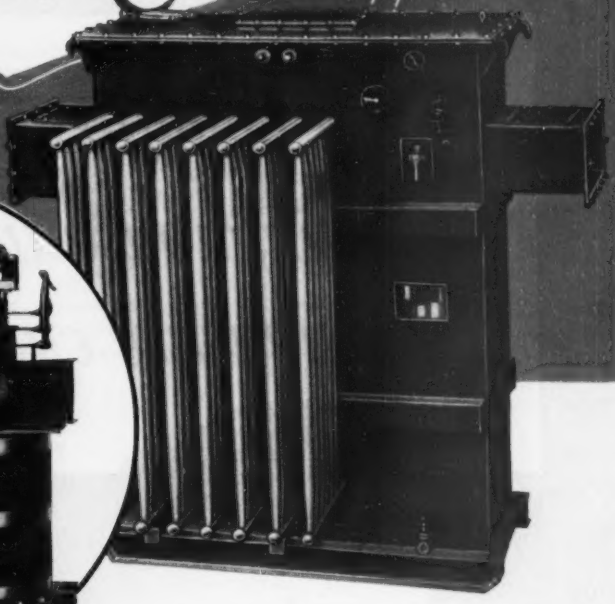
SERVICE

Uptegraff





This 1500 KVA Uptegraff indoor Unit Substation Transformer is one of three identical units supplied complete—including switchgear—by Uptegraff for a large mid-western industrial firm. The sturdy design of core and coil assembly is clearly evident in the photograph at the left. The strong, rigid tank is designed to withstand eight pounds pressure or vacuum. Transformer is designed for sealed-tank operation, and a super-sensitive electronic leak-detector is used to insure that even the smallest leaks in tanks and bushings are completely eliminated. Transformer is rated at 1500 KVA, 2400-480 volts, 3 phase.

R. E. UPTEGRAFF MANUFACTURING CO. SCOTTDALE, PENNSYLVANIA

*Who benefits by 354 different Westinghouse Instruments to measure current?**

Product Engineers

The wide variety of Westinghouse Instruments helps you to realize primary design objectives—to make your product look better, perform better, sell better. For any application there's extra design freedom in the unusual diversity in size, types of mounting, accuracy and styling . . . the almost unlimited variety of ratings and style combinations. And the performance of all Westinghouse Instruments meets ASA Standards.

Production Chiefs

Proper instrumentation of production machines, processes or power supply can help you to attain more production, closer quality control or lower production costs. Whether your needs involve measurement of amperes, volts, watts, vars, power factor, frequency or synchronism, there's a Westinghouse Instrument for the job. The line also includes many types to measure position, time, temperature and speed. And Westinghouse Instrument Application Engineers are ready to assist you in applying them most effectively.

Purchasing Agents

In the full line of Westinghouse Instruments, you have a complete source of supply —one responsibility—for all of your electrical measurement needs. Moreover, Westinghouse offers you faster service because all designs are keyed to chassis stocking and assembly procedures.

Benefit this way!

Here's an example. A leading pipeline company, in a radical departure from conventional pipeline instrumentation, is using Westinghouse Electrical Measuring Instruments in pumping stations for pressure and flow indications at various points on the system. The result: More efficient control without fire hazard; greater accuracy; substantially less maintenance—a big, long-range saving! So if you design a product, produce it, or buy for it . . . specify Westinghouse Electrical Measuring Instruments!

J-40420

*

The extensive coverage of Westinghouse current-measuring Instruments is further emphasized by the fact that there are 32 different instruments just to measure microamps.

For complete information about all Westinghouse Electrical Measuring Instruments, write for Booklet B-4696. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE... IF IT'S

Westinghouse

Cables run COOLER...
in TRANSITE DUCTS

. . . reducing copper losses
. . . increasing current capacity
. . . prolonging insulation life

YOU REDUCE copper losses . . . increase current carrying capacity . . . and prolong insulation life, when you run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 60, New York 16, N. Y.

JM

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

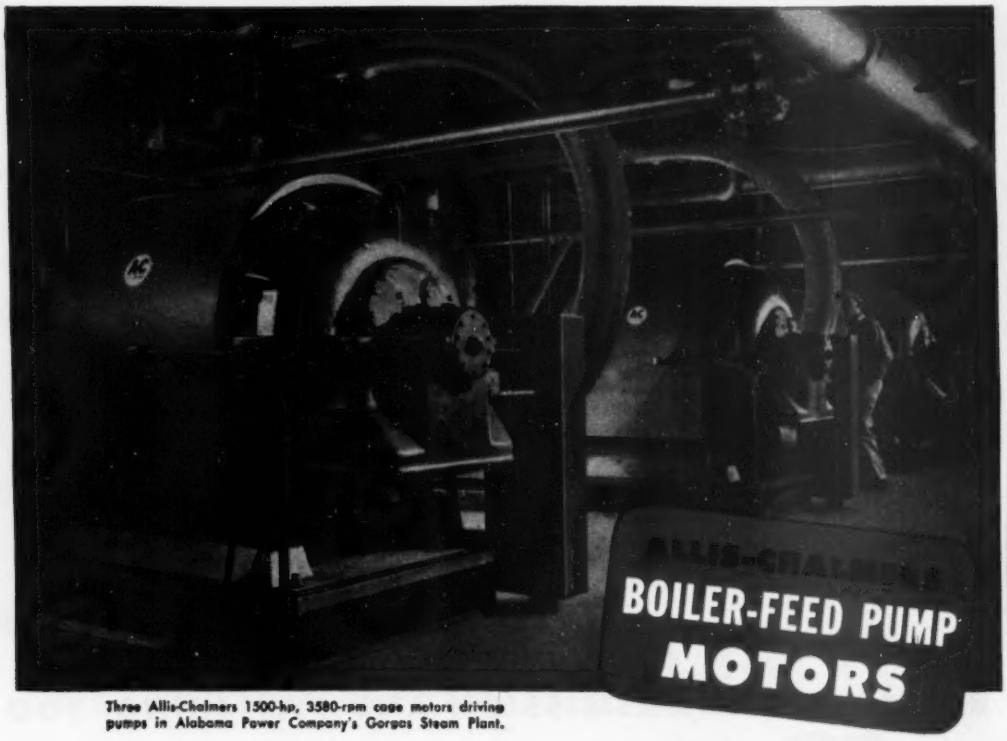
Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—73%
Earth Temp. ambient—20°C

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric loss (C)	1.9	2.1
Allowable Rise for Copper loss (C)	59.1	38.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	1.00.

Johns-Manville *Transite Ducts*

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



Three Allis-Chalmers 1500-hp, 3580-rpm cage motors driving pumps in Alabama Power Company's Gorgas Steam Plant.

Give Extra Protection TWO WAYS!

BECAUSE LOSS OF FEEDWATER can lead to extensive boiler damage, it is common practice to provide protection by means of a standby boiler-feed pump unit. It is equally good practice to insist on the additional protection of the operation-proved reliability of Allis-Chalmers motors.

YOU GET THESE FEATURES

As the result of a quarter century of development, A-C two-pole cage motors offer you these features:

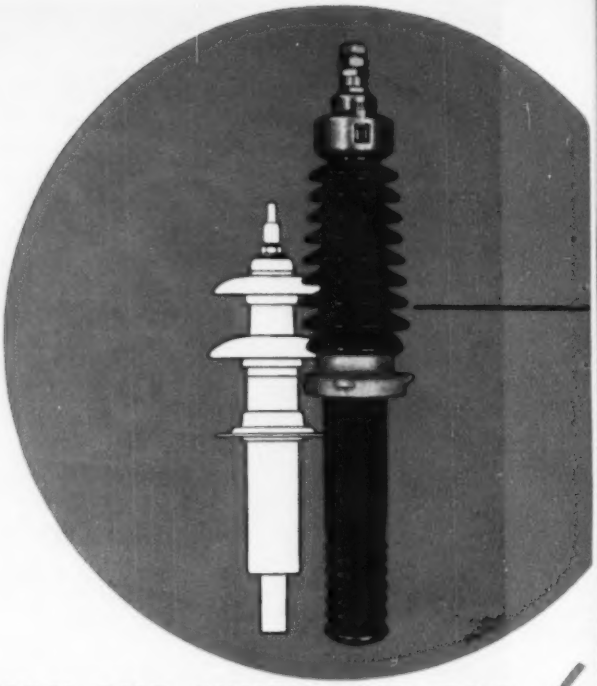
- Ring-oiling adequate for prolonged emergency operation without forced-feed oiling.
- Equalizing air pressure chambers to positively keep oil out of motor windings.
- Air distribution arrangement that eliminates hot spots in both stator and rotor.
- Forged end rings, drilled for cage bars.
- *Dew-drop* bars that give better performance and stay tight in rotor core.
- Oxygen-free copper or deoxidized copper-base alloy bars and end rings to eliminate embrittlement from silver-brazing.
- Separate steel balancing rings for dynamic balancing without weakening end rings.

BULLETIN TELLS THE INSIDE STORY

For more details about these large two-pole cage motors, ask your nearby A-C representative for Bulletin 05B7550, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3719

ALLIS-CHALMERS



BETTER FOR TRANSMISSION AND SWITCHING, TOO

LAPP LINE POST

"All-time champion" among transmission insulators in point of service dependability at duty up to 69 kv. Its record, both on new construction and after reinsulation of lines to higher voltages, has been built on ability of Line Post to avoid leakage flashover, to withstand lightning arcover and mechanical attack, its inherent freedom from puncture and cracking.

LAPP STATION POST

In addition to the superior electrical and mechanical characteristics inherent in Lapp Post design, Station Posts also possess extra rigidity. Cap and base are externally attached for large-area low-intensity compression loading of porcelain, as contrasted to small-area, high-intensity loading of nested porcelain and metal parts in conventional pin-cap switch insulators.

LAPP FOG-TYPE SUSPENSION INSULATOR

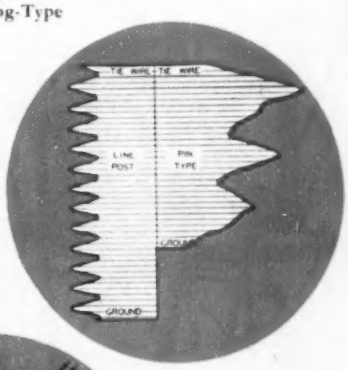
For high-voltage lines in areas of severe contamination—salt fog, industrial fumes, or dust—Lapp Fog-Type suspension units provide maximum leakage distance per length of string—and for greater effectiveness of leakage distance, inch for inch.

BETTER BUSHING DESIGN ?

It's been years since high voltage bushings have been built with the wide, spreading shells of old-time insulator design. Distribution fuses, switches, potheads, arresters, too, now use many short corrugations. Where did it all come from? Why, it's the Fog-Type design, pioneered some 25 years ago by Lapp as a notable improvement for all outdoor insulator applications. And nowhere is the improvement in performance more spectacular than in the case of insulators for high voltage transmission, switch and bus support. Superior performance of Lapp Line Post, Station Post, and Fog-Type Suspension insulators is due—in part—to two design superiorities of Fog-Type design.....

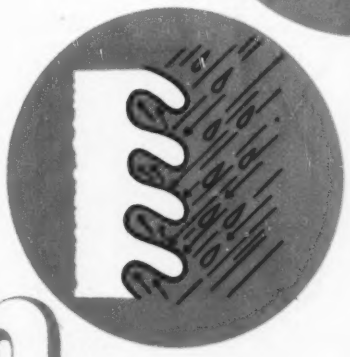
1 UNIFORM LEAKAGE PATH

Leakage flashover results from a contaminated surface which is not uniform—wet areas lower total resistance, so increase leakage current until voltage flashes over narrow shielded areas, precipitating flashover of entire unit. Compare developed uniform leakage surfaces of 66 kv Line Post (above, left) with that of conventional pin-type (right) where variation in conductivity is 3.6 times as great.



2 SELF-CLEANING

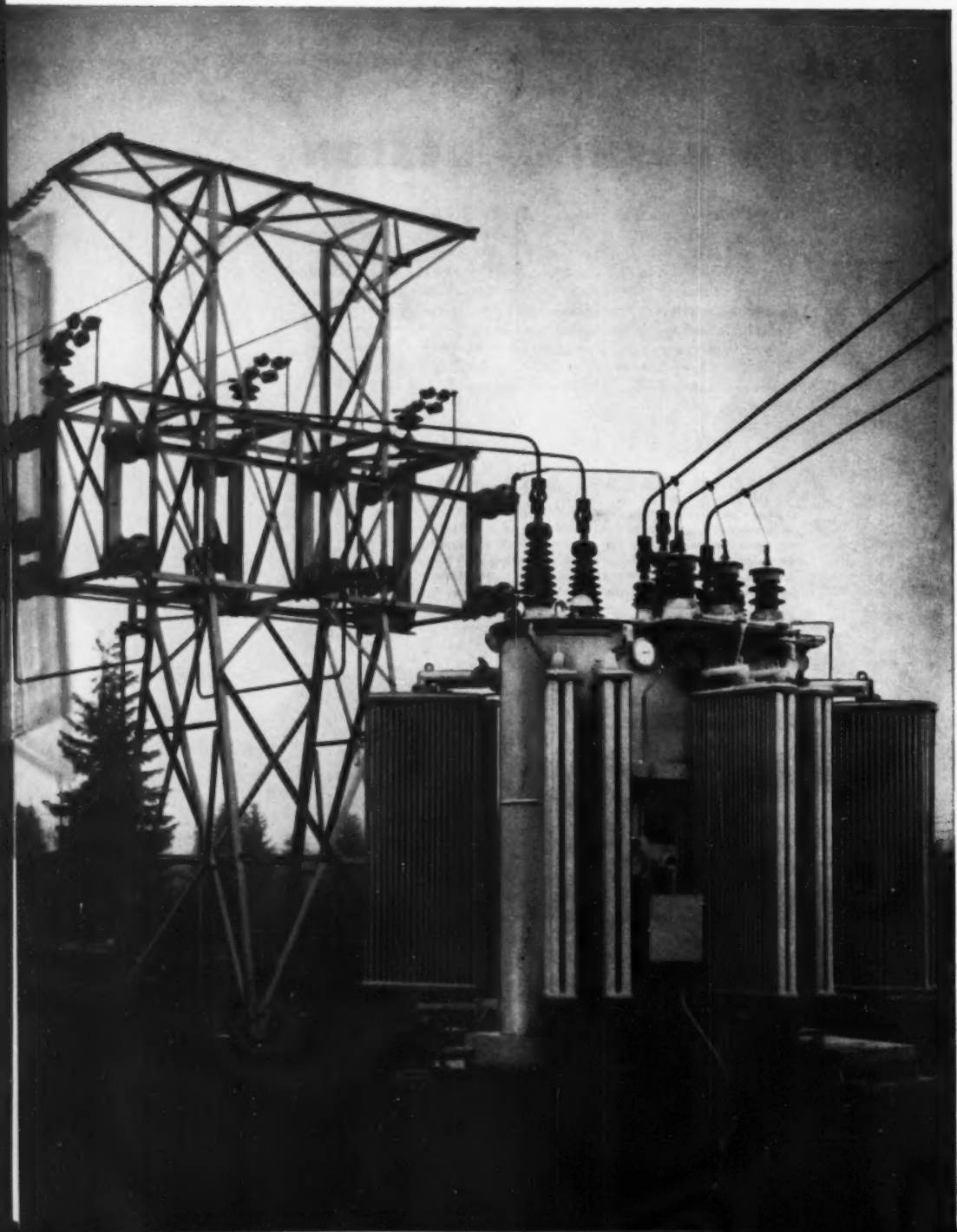
Under heavy rain and wind, contamination rapidly flushes away. Fog-Type petticoats are so shaped and spaced that rain falling on one petticoat splashes and cleans the under side of the one above. Resistance increases, leakage current falls—uniformly and over entire unit.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, NEW YORK

more power



for the pacific northwest

In an area like the Pacific Northwest, a very highly electrified area, dependable equipment is a must. That's why you'll find many Kuhlman Transformers located in key positions throughout this area.

This 3000 KVA, 3 phase, power transformer rated at 66/33 KV, plays a vital part in helping a major Pacific Northwest utility serve its many customers.

Kuhlman "know-how" began back in 1894 and for 58 years has been developing steadily. For years many engineers believed that transformer development had reached its peak. But in 1935 Kuhlman introduced the famous Bent Iron Core, the predecessor of all wound type designs. Many Kuhlman developments followed; the "Quick-Grip" bushing, oil impregnation of coils, and the forerunner of the modern series street lighting transformer.

Specify Kuhlman. Write us for the name of the Kuhlman representative in your area. For more information about power transformers, ask for Bulletin CS-601.

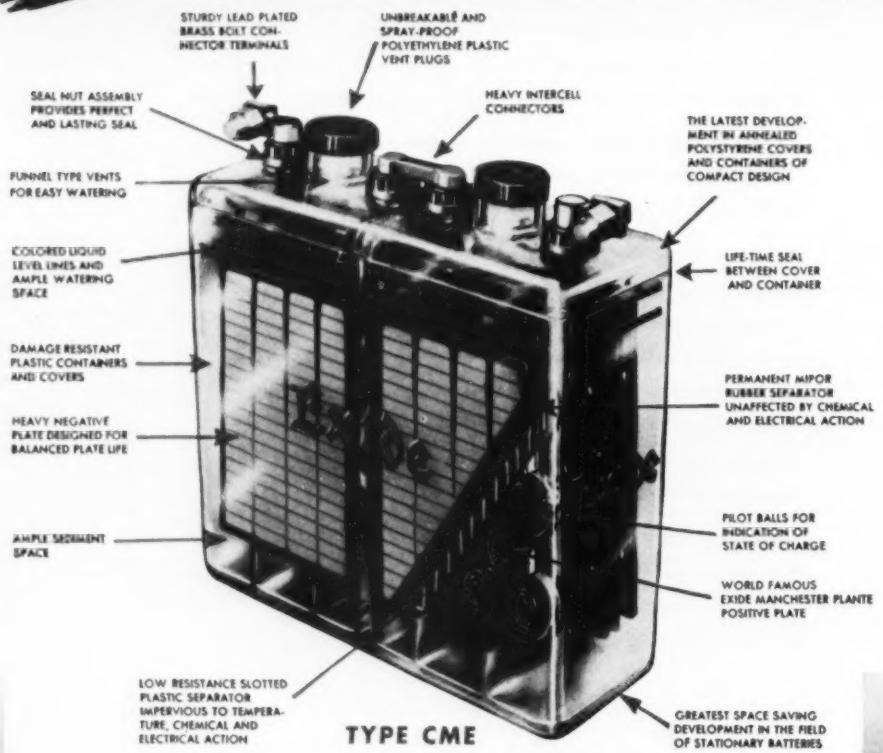
Kuhlman

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN

The complete Kuhlman line includes Distribution, Dry Type, Power, Saf-T-Kuhl, and specialty units.

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,* **67 Broad Street, New York 4, N. Y. Cable address: Microphone, N. Y.**

NEW! POWER IN PLASTIC


STURDY LEAD PLATED BRASS BOLT CONNECTOR TERMINALS
UNBREAKABLE AND SPRAY-PROOF POLYETHYLENE PLASTIC VENT PLUGS
SEAL NUT ASSEMBLY PROVIDES PERFECT AND LASTING SEAL
HEAVY INTERCELL CONNECTORS
THE LATEST DEVELOPMENT IN ANNEALED POLYSTYRENE COVERS AND CONTAINERS OF COMPACT DESIGN
FUNNEL TYPE VENTS FOR EASY WATERING
COLORED LIQUID LEVEL LINES AND AMPLE WATERING SPACE
LIFE-TIME SEAL BETWEEN COVER AND CONTAINER
DAMAGE RESISTANT PLASTIC CONTAINERS AND COVERS
PERMANENT MIPOR RUBBER SEPARATOR UNAFFECTED BY CHEMICAL AND ELECTRICAL ACTION
HEAVY NEGATIVE PLATE DESIGNED FOR BALANCED PLATE LIFE
PILOT BALLS FOR INDICATION OF STATE OF CHARGE
AMPLE SEDIMENT SPACE
WORLD FAMOUS EXIDE MANCHESTER PLANTE POSITIVE PLATE
LOW RESISTANCE SLOTTED PLASTIC SEPARATOR IMPERVIOUS TO TEMPERATURE, CHEMICAL AND ELECTRICAL ACTION
GREATEST SPACE SAVING DEVELOPMENT IN THE FIELD OF STATIONARY BATTERIES

TYPE CME

DESIGNED AND ENGINEERED TO GIVE YOU...

• LONG, TROUBLE-FREE LIFE • UNSURPASSED DEPENDABILITY for the most vital applications • LOW OPERATING COST. Extremely low internal resistance and losses, hence minimum charge currents are required • LOW MAINTENANCE COST. No solutions to change, nothing to renew. Requires water only once or twice a year. Smooth, streamline design facilitates cleaning • INCREASED POWER (watt) output per unit of space • LESS WEIGHT per ampere-hour output • MORE ATTRACTIVE INSTALLATIONS • LESS SPACE REQUIRED • HIGHLY-SUSTAINED USEFUL VOLTAGE even under heavy discharge • DAMAGE RESISTANT

Exide-Manchex BATTERY

FOR ALL SMALL-POWER STATIONARY APPLICATIONS

This newest POWER IN PLASTIC is an Exide development in stationary batteries for applications requiring up to 24 ampere hours at 8-hour rate. Back of this new Exide-Manchex battery are years of research-engineering, continuous laboratory checking and prolonged field testing. Result—a battery of *exceptional ruggedness*, with *high power ability in greatly reduced space.*

ORIGINAL . . . EXCLUSIVE . . . OUTSTANDING FEATURES

PLASTIC CONTAINER AND COVER. Transparent as glass, lighter in weight, more compact and with much greater shock resistance. Container and cover are polystyrene—impervious to effects of electrolyte . . . annealed for high mechanical strength and heat resistance . . . permanent cover seal—electrolyte will not leak out. Container surface is smooth and easily kept clean.

LONG-LIFE MANCHESTER POSITIVE PLATE . . . of unique lead button construction—rolled strips of corrugated pure lead, pressed into framework of lead alloy grid. Forming action expands buttons and locks them securely in place. Only a small portion of lead is formed initially into active material . . . the remainder is available for gradual conversion in service. NEGATIVE PLATES match the long life of the positives.

DOUBLE INSULATION—Mipor separators, of microporous rubber, together with slotted polystyrene separators act as a permanent electrical insulator while permitting free diffusion of electrolyte. Both are unaffected by temperature, chemical or electrical action—they will not crack, crumble or break down in service. They provide maximum insulation with minimum resistance between plates, and assure long battery life even under severe charge-discharge conditions.

OTHER FEATURES: Elements are precision-fit and cover-suspended; separators are held in place by a bottom support of polystyrene. Adequate water space is provided; infrequent addition of water is made easy by molded-in-cover funnel filling vent . . . unbreakable and spray-proof plastic vent plugs . . . Lines on all four sides of container show recommended upper and lower electrolyte levels. Pilot balls indicate state of charge. Supplied charged and wet—or dry for prolonged storage.

SIZES AVAILABLE in three styles of containers and in capacities of 8, 16 and 24 A.H. at the 8-hour rate. Two-cell and three-cell assemblies may be combined to provide any desired voltage and to fit the available space. Other new Exide batteries are available in plastic up to 100 ampere hours capacity.

For all small-power stationary applications these new Exide-Manchex batteries, Type CME, are

YOUR BEST BATTERY BUY . . . AT ANY PRICE

For further information write:

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"Exide" and "Manchex" Reg. Trade-marks U.S. Pat. Off.

1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952

Where only the best is a bargain!

On a really tough hauling job, a truck's either got it, or it hasn't.

You either make money or you lose it. Only the *best* truck engineered for the job is a bargain for the operator.

That's why you see so many Internationals on tough jobs. That's why you'll be money ahead to see your International Truck Dealer or Branch and get the *best* truck engineered for your job. Why not make it *soon?*

INTERNATIONAL HARVESTER COMPANY · CHICAGO

Get the facts about International's features:

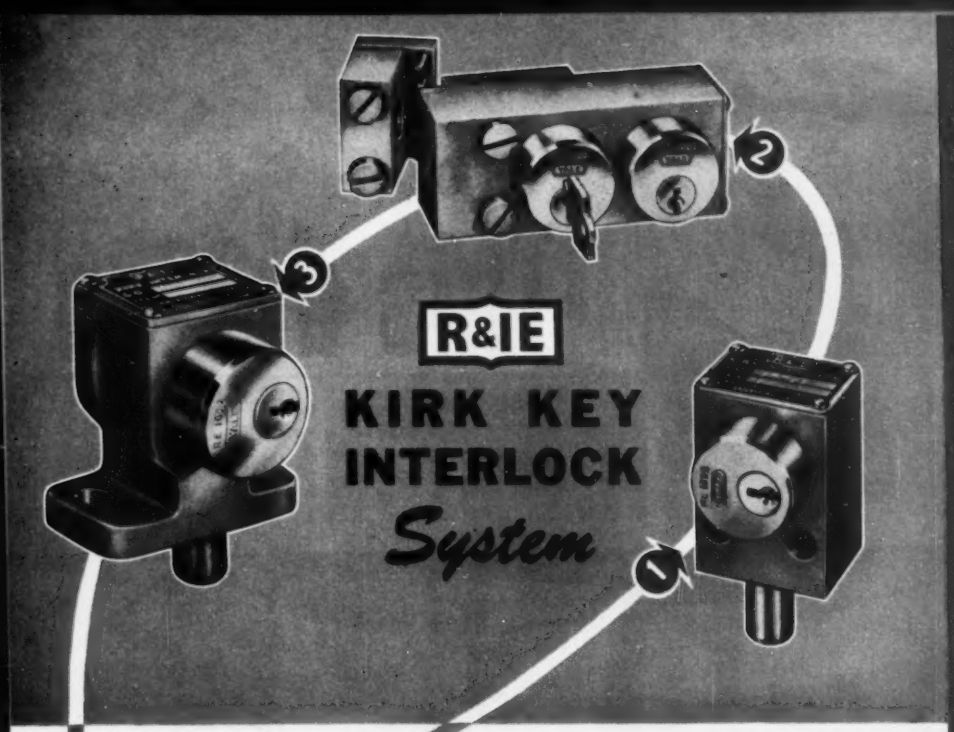
- All-truck engines—exclusively for truck work—built in the world's largest truck engine plant.
- The "roomiest, most comfortable cab on the road"—the Comfo-Vision Cab designed by drivers for drivers.
- Super-steering system—more positive control, easier handling and 37° turning angle.
- Traditional truck toughness that has kept International first in heavy-duty truck sales for 20 straight years.
- 115 basic models . . . everything from ½-ton pickups to 90,000 lbs. GVW off-highway models.
- America's largest exclusive truck service organization.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

INTERNATIONAL TRUCKS

"Standard of the Highway"

Model L-192 with special utility body and winch, 175-in. wheelbase, 25,000 lbs. GVW



KEY . . . YOUR OPERATIONS FOR SAFETY

Kirk Key Interlock Systems prevent the authorized person from doing the unauthorized thing! Added safety for your installation and equipment is provided by this device which is applied to two or more movable parts, preventing or allowing movement of one part only when another part is locked in a predetermined position. Unlimited operating schemes can be arranged in electrical installations, processing systems, fluid and pneumatic systems, etc., from combinations as shown, or multiple units of any one of them. Individual locks are mechanical and meet basic mounting requirements. Following are descriptions of the 3 types shown above:

1 **TYPE F**—For flat mounting—Can be mounted on any protective device.

2 **TYPE D**—Detachable. . . . Can be mounted on cell door, gate or compartment. One key retained with door locked open. . . . other key can be retained by operator or used to operate other devices.

3 **TYPE B**—For base mounting—Can be mounted on handle of disconnecting device. . . . Key released when lock is open.

Please write for Bulletin No. 1725 for full description, applications and typical schemes for R&IE Kirk Key Interlocks

TYPICAL INSTALLATION

Shown above is a typical installation of a Kirk Key Interlock System. Fuse compartment can only be opened when interrupter switch is locked open.

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

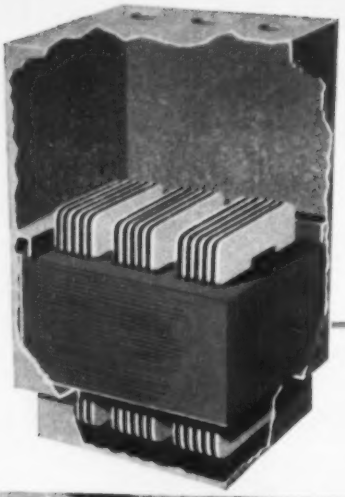
OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

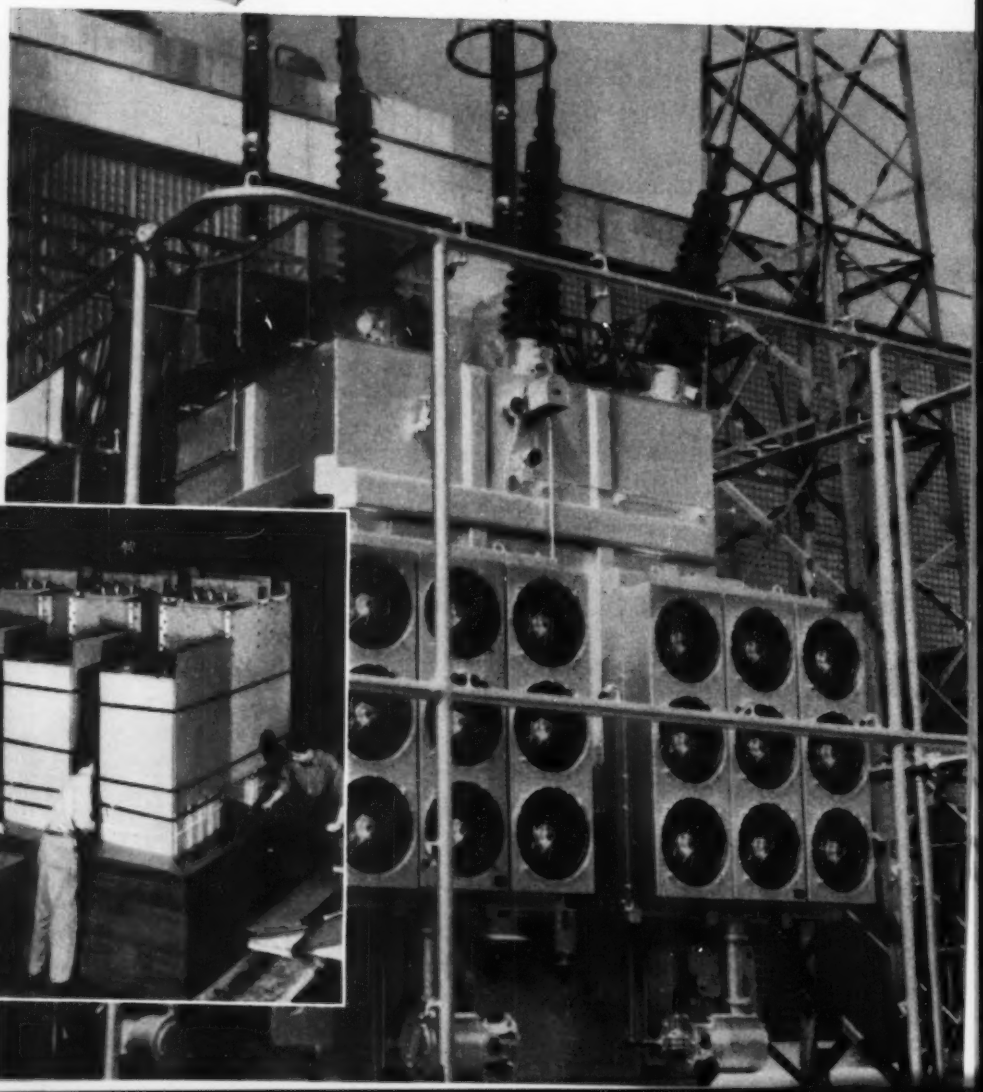
AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES



This design



knocks big figures off installation cost

When you figure *installed cost*, a Westinghouse Form-Fit Power Transformer shows substantial capital savings.

It's easier for your crews to handle; get on the line faster. Over-all dimensions are considerably smaller than comparable ratings in other designs. Weight is correspondingly lower, too. This leads to worth-while savings in both foundation and overhead structures.

The Form-Fit case clamps the core, and the core, in turn, surrounds, supports and protects the coils. This compact and sturdy construction permits a transformer to be transported to your site on its side when shipping clearances would otherwise require disassembly. Or it may be tilted at any angle to facilitate installation. This rugged construction means less danger of damage through accidental mishandling; gives added assurance that the quality built into the transformer will reach your site intact.

When you need greater transformer capacity installed on schedule at lowest capital cost, check Westinghouse Form-Fit Power Transformers. Your Westinghouse representative will be glad to give you further information, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-70626

147,500 kva
3-phase 60 cycle FOA
161 kv to 17 kv

YOU CAN BE SURE...IF IT'S
Westinghouse
POWER TRANSFORMERS

FORM-SET

...THE STRAND THAT DOESN'T UNRAVEL WHEN CUT

Every wire of Bethlehem Form-Set strand is protected by a bethanized coating. This "armor" is clean, uniform zinc, 99.9 pct pure, applied electrolytically.

Bethlehem Form-Set strand—that's the kind that doesn't unravel, doesn't unlay, after cutting. Hence it requires no seizing; there are no time-wasting preliminaries. Cut it, use it—that's all.

The reason is Form-Set's preformed construction. In preformed strand, the wires have a permanent curl; you can even take the strand apart, and still the wires won't attempt to straighten out. Naturally, therefore, a cut leaves the strand smooth and trim, with no "bushy" ends.

How about price? Does Form-Set cost more than ordinary strand? So *little* more that you'll hardly notice the difference. Form-Set strand is a buy!

We'd like to give you details. We'd like to show you how nicely Form-Set handles; how easily it slips into fittings. Whenever you say, a Bethlehem man will be glad to call.

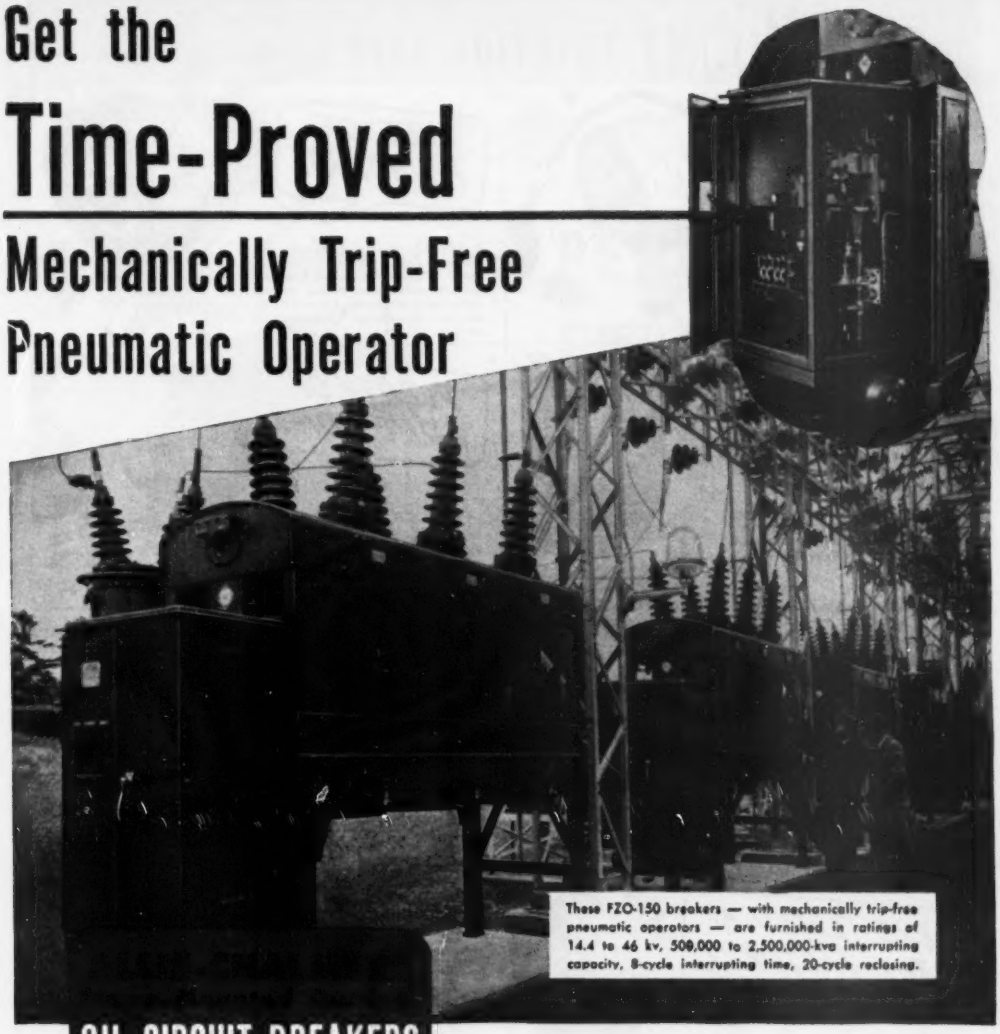
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Get the Time-Proved Mechanically Trip-Free Pneumatic Operator



These FZO-150 breakers — with mechanically trip-free pneumatic operators — are furnished in ratings of 14.4 to 46 kv, 500,000 to 2,500,000-kva interrupting capacity, 8-cycle interrupting time, 20-cycle reclosing.

OIL CIRCUIT BREAKERS

WHEN YOU SPECIFY Allis-Chalmers oil circuit breakers, you get mechanically trip-free operation. What's more — it's important to you to know that the mechanically trip-free pneumatic operation you get has been *proved in service* for over a decade.

The predominant demand for mechanically trip-free pneumatic operation for high speed circuit breaker performance is definite proof of its dependability. For details about these time-proved oil circuit breakers, ask your A-C representative for Bulletin 71B6421, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3727

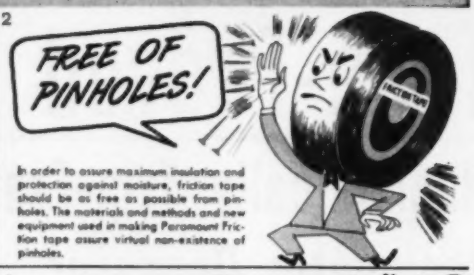
ALLIS-CHALMERS

PARAMOUNT FRICTION TAPE by Haartz-Mason

1

Made under the most exacting requirements in the industry, Paramount Friction tape can be tightly wrapped — yet can be torn readily as required. A margin of safety in this respect is added to every roll of Paramount Friction tape.

2



In order to assure maximum insulation and protection against moisture, friction tape should be as free as possible from pinholes. The materials and methods and new equipment used in making Paramount Friction tape assure virtual non-existence of pinholes.

3

Automatically cut with smooth, neat edges on Cameron cutting machines. These machines wind it on the cores under tension. This is your insurance against ravelling.

4

Under controlled temperature and humidity, Paramount Friction tape is strictly tested for permanence of adhesion.

5

Taken from stock at regular intervals, sample rolls of Paramount Friction tape undergo accelerated aging tests in an electric oven at 212° F. for 16 hours. Thus you get a guarantee of maximum aging ability.

6

Every roll of Paramount Friction tape is sold with guaranteed minimum footage per roll plus . . . guaranteed weight. You are left in no doubt about what you are getting. And so you know you will cover the largest area most efficiently at the lowest cost.

7

To sum up, Paramount Friction tape, besides being made of finest materials, also undergoes rigorous pre-testing at the factory. Among the rigidly conducted tests are those for aging, adhesion and strength.

Dual Guarantee on Weight and Length

Manufactured by

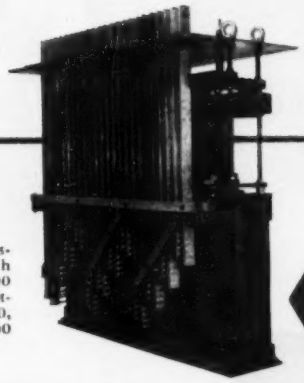
Haartz-Mason, Inc.

WATERTOWN 72, MASS.

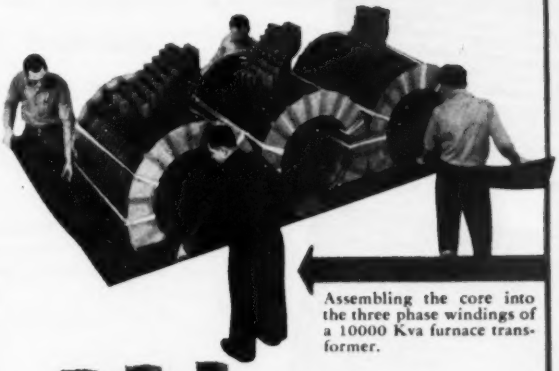
Rivet Leaders of the World Association

NOW *15 years of Proof*

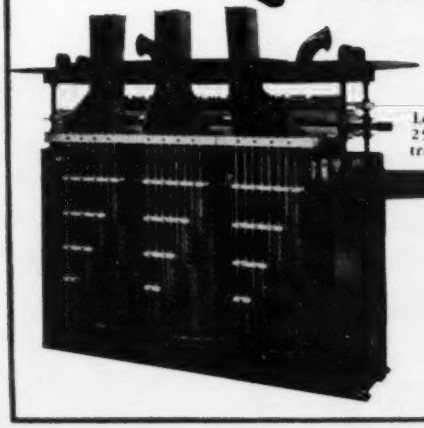
behind the design of each PENNSYLVANIA FURNACE TRANSFORMER



2500 Kva Transformer; High voltage — 3300 volts; Low voltage — 140, 130, 120, 110 and 100 volts.



Assembling the core into the three phase windings of a 10000 Kva furnace transformer.



Low voltage side. 25000 Kva furnace transformer.

Fifteen Years Ago... Pennsylvania Transformer Company introduced a new type of helical winding in the low voltage coils of a 2500 Kva furnace transformer. Since then, Pennsylvania has manufactured over 1¼ million Kva of furnace transformers using the same fundamental principles of design employed in this 2500 Kva unit.

In all the intervening years, there has *never* been a low voltage winding breakdown on any of these furnace transformers. Because this design is basically and fundamentally correct, Pennsylvania can build furnace transformers for any size electric furnace now being manufactured or being contemplated for future construction.

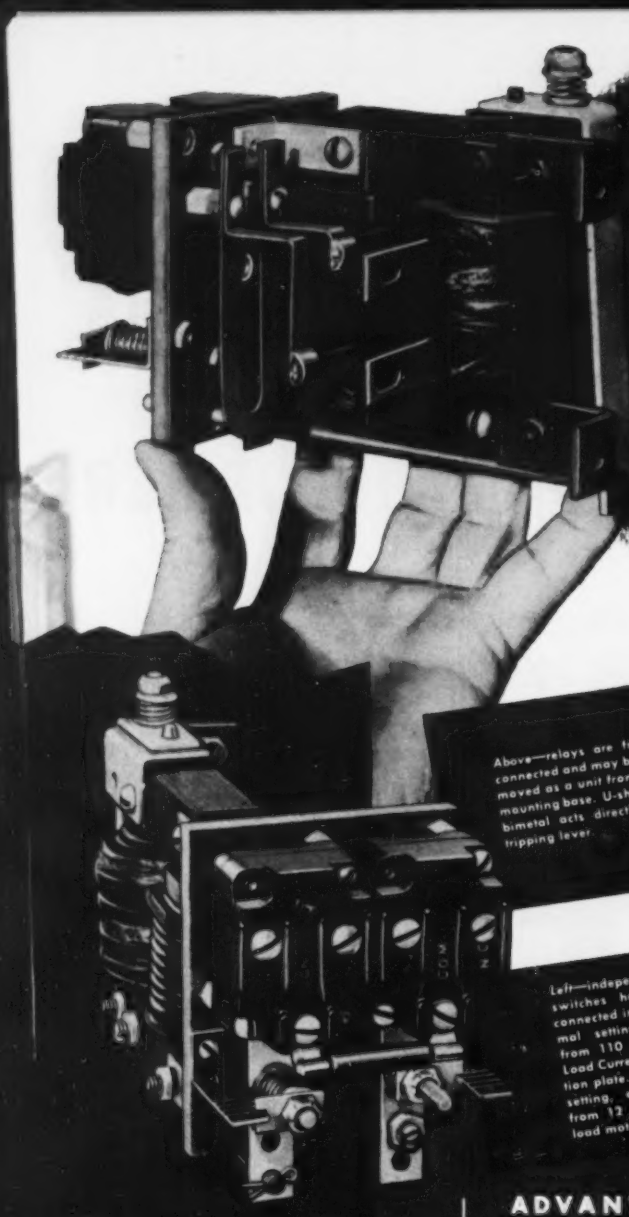
Pennsylvania

TRANSFORMER COMPANY

CANONSBURG, PA.

Greater Pittsburgh District

New EC&M..



Above—relays are front-connected and may be removed as a unit from the mounting base. U-shaped bimetal acts directly on tripping lever.

Left—independent micro-switches have contacts connected in series. Thermal setting, adjustable from 110 to 125% Full Load Current, has calibration plate. Instantaneous setting, also adjustable from 12 to 25 times full load motor current.

1 Instantaneous Trip (magnetically)

2 Timed Responsive Trip (thermally)

on Single Phase, Failure to Start, during Running, etc.—*all* in this *one* relay

ADVANTAGES

THERMAL-MAGNETIC *Overload Relays*

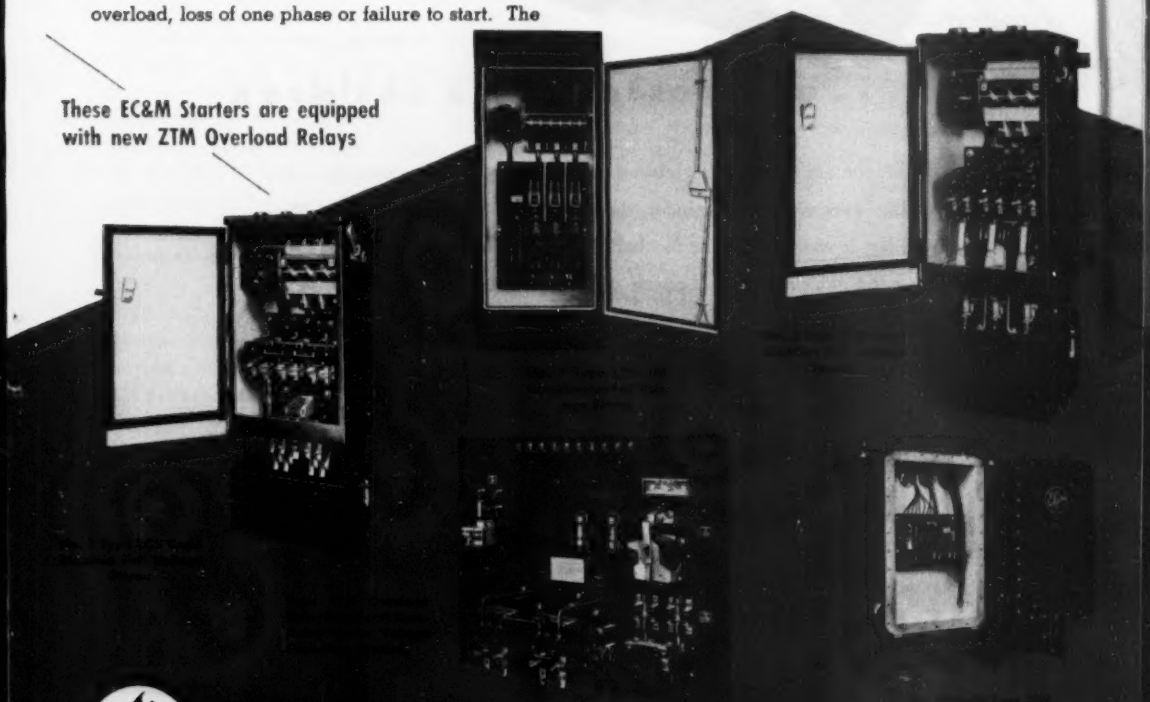
Completely Protect A-c Motors under all conditions

DIRECT-ACTING . . . NO DASHPOTS

Thermal-Magnetic tripping characteristics — an ideal combination of proved advantages—to give complete protection to the a-c motor under *all* conditions. On squirrel-cage, synchronous and wound-rotor motor starters and controllers, these relays provide positive, *timed-response* to the thermal energy of load currents.

They protect the motor from overheating due to overload, loss of one phase or failure to start. The life of motor insulation is increased by keeping temperature rise within safe limits. Useless tripping on harmless temporary overloads is eliminated.

On higher values of current resulting from short circuits, damage is minimized by instantaneous trip, causing the starter to open and disconnect the motor from the line.



These EC&M Starters are equipped with new ZTM Overload Relays

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET • CLEVELAND 4, OHIO

You . . . are Yesterday's Children

YES, you are yesterday's children. You . . . the banker, the lawyer, the utility executive, the engineer, the purchasing agent, and so on! Yesterday, it was baseball or football. Today, it's business . . . and business is good . . . or bad . . . because of your planning and decisions.

Many utilities today are enjoying the fruits of wise planning and direction, planning which foresaw today's volume and requirements. That many of you chose Moloney equipment in preparing for this peak, is a tribute to your foresight and to our integrity in producing only the best and most dependable equipment . . . to help you give *better* service . . . at *all* times.

M692-19

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = { BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

A Silly Question

How much should electric house heating cost the user?

The complete answer to that question appears in a "Case History in Electric House Heating" on page 50 of "Electrical Merchandising," May 1947. Included is a comment from the housewife. It is,

"We think electric heat is fine. Of course, we'd like it better if rates were lower."

The average price per kwhr for heating this house, according to the figures given, was less than 8 mills.

There is the answer. However low the cost of electric house heating, the user would like it to be lower. Same as potatoes and lipstick and onions and newspapers and gin and all necessities, everything for which we have to shell out the nickels—we'd all like it better if the cost were less.

But all the same, we buy what we want. The price we pay is the value we put upon what we want. It is becoming increasingly apparent that more and more people are wanting electric house heating. And they will pay what it costs, whether the price per kwhr is less than 8 mills or more than 2¢.

For those who sit chewing their knuckles, worrying about the cost of electric house heating, we have a suggestion. It is that they ponder over an outstanding fact in the history of the electrical industry. Every single one of the services of electricity, as each has come upon the scene, has been sold at a price higher than that of the service against which it competed. People bought electricity for lighting at 24¢ per kwhr when kerosene was 5¢ a gallon.

It is a perfect exercise in futility to compare electricity at "w" cents per kwhr with oil at "x" cents per gallon, gas at "y" cents per M, and coal at "z" dollars per ton. Results from such comparisons mean nothing. They simply say that electricity, oil, gas, and coal each cost so much. And what of it?

The only thing that has come of these comparisons is a bad thing. It has caused a lot of electric utilities to tell their customers that electricity costs too much. Heaven knows there are enough voices screaming that big lie without the utilities joining in the chorus. It makes no difference that they say electricity costs too much for house heating. This is agreement—partial, but still agreement—with those who shout that electricity costs too much.

There was a time within the memories of many living today when electric lights were to be seen only in the homes of the rich. Electric house heating, in spite of what is often said, does not labor under the handicap that lighting did then. Electricity for lighting was really expensive in those years, but the people who wanted it enough to pay for it had it. Today, electricity is not expensive for any use. And the people, any of the people not just the rich, can buy, will buy, electricity for heating their houses if they want it. And it won't make any difference to them if oil, gas, and coal are cheaper.

Not Proper Rate-Making, but It's Legal

Recently when the Federal Power Commission was called upon to rule on rates to be paid for SPA power sold to Arkansas Power & Light Co, the commission found itself under considerable pressure. It came from SPA's parent, the Interior Department, and Arkansas politicians who didn't want to see a big aluminum project for whom the power was intended seek "greener pastures."

FPC put its approval on satisfactory rates, low enough to keep the plant in Arkansas but still said to be higher than those for any other regularly operated aluminum plant. But the reasoning behind its ruling makes an interesting story. FPC Chairman Thomas C. Buchanan told it to a special House Committee on Civil Works soon after the rate decision had been handed down.

The main controversy was over allocation of costs to power and other functions of the dams built by the Army Corps of Engineers. FPC and the Corps have held that costs of the power functions of a multipurpose dam should include not only the equipment and structures used directly and exclusively for power generation, but also a proportionate share of the dam itself. This is known as the joint-cost method—in this case $418 million.

SPA and Interior based their estimate of the cost on the power generating equipment and structures only. This is known as the increment method of figuring costs—in this case $218 million.

As Chairman Buchanan explained:

"First of all, we departed from what you might call the rate base—the allocation of costs where we usually pull in some joint costs . . . and went into incremental costs. That is what it amounted to. We did not say so, but that is what it was.

"We took the lower figure of $218 million. Then instead of using the 50-year figure, we took the SPA figure which was an amortization or a service life basis. In other words, some parts of the project would wear out in 30 years, some would last 70 years, and some would last 100 years. That is a service life approach. We took that basis with a figure of 100 years and not to exceed 100 years. On that basis we approved those rates. It is not our normal rate-making approach."

Later, he said, "It is not our normal approach, and we do not believe it is a proper approach." He further said, however, that the approved rates were within the law.

The rates may be legal. But most of the industry will agree that they are not economically sound.

A Lesson to President Truman and Editors

The Associated Business Publications has joined in the protest against President Truman's seizure of the steel mills. At its recent spring conference the ABP passed this resolution which read in part:

"Be it resolved that the recent action of the President of the United States in seizing property in defiance of the limitations imposed upon him by the Constitution and the laws of the United States and in the face of a legal alternative provided by the Congress is hereby condemned as a tyrannical exercise of power; and be it further resolved that the seizure in question should be a matter of deepest concern on the part of every American, and the occasion for prompt action by Congress."

This should be a lesson to the President. He shouldn't have seized the steel mills all at once. Everybody recognizes that such action leads to socialism or something worse. The way the job should have been done is the way the government has been infiltrating the power industry. Creep up on 'em. That's the way. Charge that there is a shortage of steel. Then build steel mills one at a time. Absolve the government mills from paying taxes. Undersell the steel trust. Provide subsidized steel for the "people" whoever they are.

In a less facetious manner we might suggest that the business publishers need a lesson, too. They say the seizure was "occasion for prompt action by Congress." But for over 15 years it has been Congress that has been voting the funds for federal power agencies to build power plants and lines duplicating existing lines of private companies. They have been giving such agencies preference in the tax laws and preference in buying the tax-free power.

Some day Congress may act to put an end to creeping socialism. But it won't be until the voters have convinced the lawmakers that if they support government seizure of and competition with private business, they won't be returned to their jobs in Washington.

Statistics When You Need Them

How often have you been discussing the industry with someone and have been forced to say, "I am not sure what the exact figures are, but I have them at the office." There was a time when such an answer was excusable. But that time is gone. It went with the publication of the "EEI Pocketbook of Electric Industry Statistics." This 32-page booklet (3½ by 6¾ in.) has all the figures you will normally need in a discussion of the industry. The 24 tables cover everything from generating capacity to purchasing value of the dollar. You can get a copy for 50¢, lower prices on bulk orders, from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

Vote—Vote—Vote

Six months from now all American citizens over the age of 21 will have an opportunity to go to the polls and elect the next President of the United States. Unfortunately not all those eligible to vote will avail themselves of this great opportunity. Judging from past elections four out of ten will remain away. Among this large minority will be many who will spend the next four years criticizing the man elected. And many of this group we feel sure will be from the electric utility industry or related in some way to those employed by that industry.

This is regrettable. But votes not regrets win elections. Every electric utility company, every industry, every profession has an obligation to encourage 100% voting. Important as selecting a presidential nominee may be, electing him is even more important. Now is the time for electric companies to carry to their employees and through them to their families, relatives, and friends this message: "Vote, vote as you please, but vote."

Only by a long strenuous campaign can many Americans be encouraged to exercise their political right—a right that means so much to the future of the American nation and people.

THE ELECTRICAL WEEK

Featured in the News

President Truman hints he may ask an investigation of the power industry (p 70) . . . EEI predicts reserve of 9.2% next December (p 72) . . . Television camera developed that could be used to inspect underwater cables (p 73) . . . Government agencies in the West are taking precautions against floods (p 74) . . . Utility experts from United States visit British power system (p 75) . . . Public relations and advertising reviewed (p 76) . . . Phil Sporn feels the economy will be stable for the year to come (p 77).

• • •

Latest from Washington—Some NPA experts hope that controls on copper can be removed by late 1953 assuming there is no shooting war . . . Look for another blast at electric companies when President Truman speaks at Bull Shoals Dam dedication in Arkansas on July 2 . . . Dale E. Doty received Interior Department's Distinguished Service Award the day before he was sworn in as an FPC member . . . REA has approved $1.4-million loan to Pennyrile Rural Electric Co-operative, Hopkinsville, Ky., for distribution and transmission line construction.

A Senate subcommittee last week began marking up Interior Department's appropriations bill for submission to full committee and Senate . . . First International Reclamation Conference is to get underway June 2 at Yakima, Wash., with delegates representing 20 foreign nations . . . NPA expects to announce decontrol of aluminum wire and cable shortly. This is in accord with vigorous recommendations of Aluminum Industry Advisory Committees that aluminum controls be relaxed by fourth quarter. Under proposal, consumers would disregard third quarter allotments that have already been issued and would self-certify for their full requirement.

From West South Central—Arkansas P&L asks PSC approval to sell its Pine Bluff office building to New York Life Insurance Co for about $1.9 million. AP&L plans to lease the building at $104,000 annual rental.

From Mountain Region—Gallup, N. Mex., Electric Power Board approves $712,000 expansion program, dimming prospects Public Service of New Mexico might buy the property.

Construction—Jersey Central P&L will install 125,000-kw unit at Raritan River plant at Sayreville, doubling this installation's generating capacity . . . Commonwealth Edison begins construction of substation powerful enough to handle the output of 800,000 kw of generating capacity.

Financial—Houston Lighting & Power plans to offer about $14.3 million, 3¼% convertible debentures to common-holders on basis of $3 principal amount of debentures for each share of common stock held. Company will pay Sept. 10 a common dividend at the rate of $1 annually per share compared with 80¢ at present . . . Columbus & Southern Ohio Electric and Ohio Edison enter into agreement to exchange certain electric facilities in Madison, Franklin, Fayette, and Union counties.

Foreign—British Electricity Authority has installed reputedly the largest three conductor 132-kv impregnated pressure cable from Barking power plant to Ilford. Cable is made by British Insulated Callender's Cables Ltd, affiliated with Okonite Co . . . Spanish Railways get first of 20 electric locomotives being built by Preston Works of English Electric Co, Inc. Each locomotive will be 3,600 hp, 3,000 volts dc.

Labor—Connecticut Power, Stamford Division, and IBEW, AFL, agree to 4½% wage boost, effective May 1 . . . In NLRB election, Glen Lyn substation employees of Appalachian Electric Power voted against unionizing as follows: 92 against; 16 for IBEW, AFL; and none for UWUA, CIO . . . Denver Building Service Employees Union will strike June 1 against Public Service Co of Colorado "if we fail to get a satisfactory contract, or if negotiations appear hopeless," Dick Cordtz, international representative for union, declares.

Rates—Eastern Shore Public Service Co asks Maryland PSC approval to increase rates about 10% . . . New Jersey State Supreme Court affirms order of Board of Public Utility Commissioners denying New Jersey P&L a $976,200 annual rate increase.

Congress' failure to act on St. Lawrence power project spurs Hydro Electric Commission of Ontario to construct a second power tunnel under Niagara Falls, Ont., so the additional five units at Sir Adam Beck Station No. 2 can be installed (EW, May 26, p 15), Chairman Saunders says.

More than 20% of young men in America can't see well enough to qualify for military service, Illuminating Engineering Society Pres Samuel G. Hibben tells regional group in Pittsburgh. He says society is working toward prevention of eyestrain as a means of preserving human vision.

Republican Rep George Dondero of Michigan introduces a House resolution calling for a full Congressional investigation of the "self-styled electric consumers conference" (see page 70).

U. S. Supreme Court has upheld a FPC rate reduction on power sales made to Consolidated Gas Electric Light & Power of Baltimore by Pennsylvania W&P. Decision is expected to mean restitution of some $3 million to Consolidated, which has promised to pass it on to its customers. However, exact amount to be returned by Penn Water will be subject to further litigation.

Congratulations—Public Service of Northern Illinois elects Robert F. Creutz vice president, succeeding H. S. Patton, resigned . . . Superior Water, L&P elects L. A. Nichols, general sales manager, vice president . . . New Orleans Public Service elects Gerald L. Andrus, comptroller, vice president.

WASHINGTON COMMENT

JESSE MOCK

One of the more tantalizing unknowns in the future of the electric power industry is the role to be played by the Atomic Energy Commission.

It appears entirely possible that this government agency will have a greater impact on the industry within the next 20 years than the regulatory agencies have had in the past 20.

AEC is in a position to exert influence on the industry in two vitally important ways:

1. As one of largest electric power customers the agency is demanding new approaches to fill its power requirements.

2. Through its research program it will eventually develop a new fuel source for generation of electric power.

During this month it is estimated AEC will be using approximately 2% of the national output of electric energy. Within a few years the percentage is likely to double. And for some time to come it is expected the agency will be using a much larger amount of electric power than can be generated with the use of atomic energy even if it were used for that purpose.

AEC Demands Bring Changes . . . These huge demands are already bringing about changes in several phases of utility operations. Company groups such as Electric Energy, Inc. which will serve the Paducah AEC Plant, are coming into the picture. This is a departure from the usual electric utility organization where a single independent company, financed by individuals, supplies the power needs of a community or industry.

Securities and Exchange Commission, which keeps a close watch on the registered holding companies, had to make exceptions for some of the companies participating in the EEI group. In the case of Union Electric Co of Missouri, SEC decided that since the EEI project was not "business as usual," it merited postponement of "regulation as usual."

AEC plants such as the one being constructed at Paducah are also expanding the area in which public and private utilities must integrate their facilities to meet customer demands. Tennessee Valley Authority along with the EEI plant will serve AEC at Paducah. For interim power at Paducah a number of electric companies are tied in with TVA to meet requirements.

Existence of the huge, concentrated, high-load-factor requirements of AEC almost certainly will speed new technical developments in generating plants. Whatever progress is made in this direction will be passed on to the industry.

Big Business for a Big Country . . . But more important, the huge AEC power demands are forcing intelligent men to reassess their thinking about American business. Thus we see the appearance of such articles as the one presently appearing in Collier's called "Big Business for a Big Country," written by former TVA and AEC Chairman David Lilienthal.

These new approaches both abstract and concrete result in part from AEC's role as a customer of electric power. They are already having an effect on the electric utility industry.

At this point it would be largely "ivory tower" guessing to predict the impact on the industry of the emergence of atomic energy as a source of electric power. But when an economical means of producing electric power from nuclear fuels is found, there will be some drastic changes.

In the past the electrical industry has studied government agencies as regulators or competitors. In AEC the industry has a customer and innovator.

Playing these two roles, the agency is in a position to impose positive changes on the industry. Decisions being made now will determine the extent of those changes.

TECHNICAL NOTES

ARCHER E. KNOWLTON

One ampere outflow for one year of electrolytic corrosion is attended with a loss of as much as 20 lb of iron or steel or 70 lb of lead.

Plastic rail tie-plates are under test to determine whether (in addition to electrical insulation and corrosion resistance) they have the strength and durability of steel.

Gravel is usually dirt cheap but now it has a synthetic competitor composed of dirt, sulphite liquor, and inexpensive chemicals.

Detachable switchgear could conceivably jam while being pulled out for inspection or maintenance: Is the only answer to kill the bus?

Public pressure for housing substation equipment may obliterate much if not all the gain from factory-assembled metal-housed gear.

Troubles feared by early skeptics about metal-clad equipment never materialized after their courage got the better of them.

By-passing regulating transformers gives no assurance that a carrier signal will take the detour. It may still partly go through and emerge to give a scrambled out-of-phase signal.

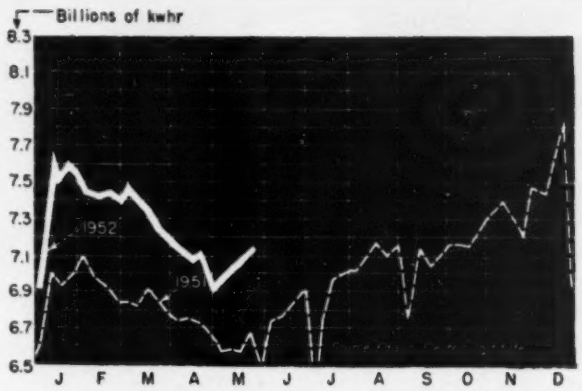
Long transmission routes may necessitate repeaters for the carrier to offset the db loss from distance attenuation and diversion.

Human heart fibrillating for 1¾ hours as a result of minor surgery shock at Chicago Presbyterian Hospital was restored to normal rhythm after ½ second application of 110 volts across the exposed organ.

Electric marvels asked of his RCA associates by David Sarnoff for his 50th anniversary in 1956 are; an electronic air conditioner, a tape recorder for television, and an amplifier for light.

Aerating agents or detergents used for industrial foaming when added to concrete mixes entrain air up to 45% of the volume of (light) concrete. One detergent is a proprietary sodium lauryl sulfate.

STATISTICS



Output Week Ended May 24—7,146,204,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
May 24	+7.4	+1.6	+4.0	+6.6	+6.0	+15.7	+7.4	+7.7	+4.9	+7.3
May 17	+8.4	+5.6	+5.7	+7.3	+6.0	+15.5	+10.3	+8.7	+5.0	+7.9
May 10	+7.2	+2.4	+4.1	+3.3	+6.9	+13.9	+15.9	+6.4	+6.5	+9.3

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Loads (Million Kw)	Mar.	66.5*	66.9	61.4
Capacity (Million Kw)	Mar.	76.34	75.99	70.25
Production (Billion Kwhr)	Mar.	33.04	31.54	30.92
Hydro		10.44	9.46	9.22
Fuel		22.60	22.07	21.70
Fuel Consumption				
Coal (Million Tons)	Mar.	8.84	8.74	9.03
Oil (Million Barrels)		5.22	4.77	5.53
Gas (Billion Cu Ft)		57.39	54.82	48.48
Sales (Billion Kwhr)	Mar.	29.03	29.08	26.77
Residential		8.32	8.51	7.35
Commercial		4.85	4.87	4.44
Industrial		13.98	13.82	13.12
Other		1.87	1.88	1.86
Net Income Class A & B Companies ($ Million)	Mar.	82.65	88.00	71.10
Estimated Dec. 52 Peak (Million Kw)	Mar.	80.4	80.5	78.2
Kwhr per Residential Customer (12 Month Average)	Feb.	2,037	2,021	1,867
Revenue per Kwhr Residential Service (12 Month Average)	Feb.	2.80¢	2.81¢	2.86¢
Canadian Production (Billion Kwhr)	Mar.	5.22	4.97	4.91

Business Statistics

FRB Industrial Production Index†††	Mar.	217*	218	219
Gross National Product Annual Rate ($ Billion)	1st Qtr.	339.0*	334.6	319.5
E. W. 5 Industry Production Index	Apr.	124.0*	123.8	122.6
ENR Construction Cost Index††	May	116.8	116.2	113.6
BLS Consumer's Price Index	Apr.	188.7	188.0	184.6
NEMA Insulation Materials, Sales Index†	Mar.	536	528	662
NEMA Electric Appliance Sales Index†	Mar.	278	224	422
NEMA Household Refrig. Sales Index†	Mar.	163	153	330
Metal Prices (May 26)				
Copper, Conn. V., lb		$ .24½	$ .24½	$ .24½
Lead, N. Y., lb		.15	.19	.17
Zinc, prime Western E. St. Louis, lb		.19½	.19½	.17½
Tin, Straits, qual. N. Y., lb		1.21½	1.21½	1.39
Aluminum, ingot, base price		.19	.19	.19
Nickel, base price		.56½	.56½	.50½
Steel, billets, Pitts., ton		56.00	56.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Estimated. † 1936=100 †† 1949=100 ††† 1937-39=100 (Unadjusted)

Changes in Households, Families, and Couples

The number of married couples and the number of families have both increased about one fourth since 1940 according to the Bureau of the Census. Of the 36 million married couples in the United States in April of 1951, 1.7 million or about 5%, were sharing living quarters with other persons or living in hotels, or rooming houses.

Couples not maintaining households of their own constituted 6.8% of the total in 1940, 6.1% in 1930.

The average size of the 39.8 million American families in 1951 was 3.5 persons, as compared with 3.8 in 1940.

The number of households was about 44.6 million, in April 1951 as compared with 34.9 million in 1940, 29.9 million in 1930, and 12.7 million in 1890.

The average size of household number of households since 1940, roughly 875,000, is far in excess of the average annual increase of about 504,000 between 1930 and 1940, and of 430,000 between 1890 and 1930.

The average size of the household declined from 4.9 persons in 1890 to 3.7 in 1940 and 3.3 in 1951.

The creation of small new households has been so rapid during recent years that the decline in the average size of household has continued in spite of the extraordinarily large number of births during the war and postwar years.

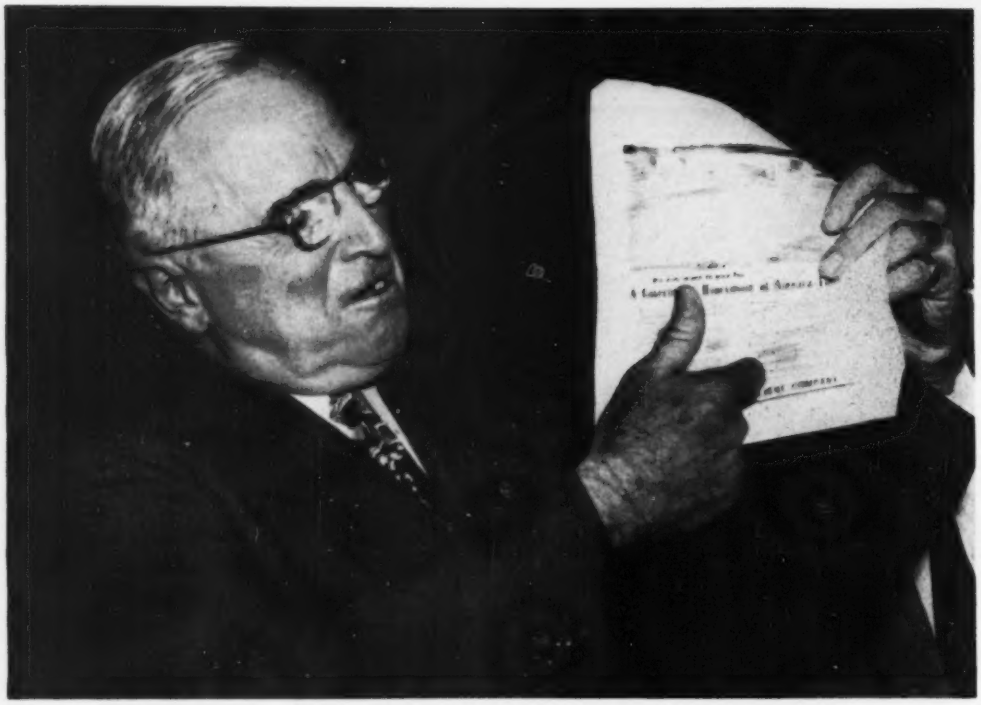
Households, Families, & Couples

	(Millions) Households	Families	Couples
1951	44.6	39.8	36.0
1950	43.5	39.2	35.9
1949	42.1	38.5	35.3
1948	40.7	37.3	34.3
1947	39.1	36.2	33.4
1940	34.9	32.2	28.5

During each decade since 1890, the proportion of single persons has declined. Preliminary results of this sample survey indicate that it is at the lowest level on record.

The long-range decrease has been due in part to gradually rising marriage rates and to an increasing proportion of the population in the older age groups.

Since 1940 the trend has been greatly accelerated by unusually high marriage rates and by the sharp decline in population in the teens where single persons predominate.



PRESIDENT TRUMAN tells public power lobby group that this advertisement may violate the Corrupt Practices Act

Truman Begins Private Power Attack

Tells charter meeting of Electric Consumers Conference companies' advertisements follow Soviet and Fascist line

President Truman said last week the large advertisements electric utilities buy to combat public power may be in violation of the Corrupt Practices Act, and that he intended to ask the Attorney General to look into the matter.

These off-the-cuff remarks were made before a group of more than 500 public power enthusiasts at the charter meeting of the Electric Consumers Conference in Washington. Chief purpose of the conference was to organize a permanent public power lobby and pressure group.

Displays ECAP Ad . . . Holding up a full-page advertisement produced by the Electric Companies Advertising Program and titled, "Do You Want To Pay for a Government Honeymoon at Niagara Falls?", Truman said: "I think you people ought to do everything you possibly can to get the facts on such things as this. And I think also there may be something going wrong under the Corrupt Practices Act. Through the rates that these companies charge, you are paying for that. And the tax collections of the government are not so great because they charge these off as expenses of operation.

"I think I will ask the Attorney General, when he gets in office—and I have had a hard time getting an Attorney General—to take a look at this situation and see if the Corrupt Practices Act doesn't apply."

Election Issue . . . The President left no doubt he intended to make public power a campaign issue. He said the power resources belong to the people of the United States and not to anybody else. When the whistle campaign starts, he added, he intends to go out and give the people all the facts with regard to the power situation.

"There is a terrible barrage of propaganda going around these days on behalf of the poor private power producers," Truman commented. "These poor private power monopolies are asking for a fight. And I hope you will give it to them. And I will join you in it."

He said it would not be easy to answer the power companies' propaganda program because they were spending millions and millions of dollars on it.

He has nothing, he said, against private ownership of industry. "But I don't want that private ownership—which is partly a public institution—to have the throat-hold on the

people whom they serve. That's all I am fighting."

Scare Campaign . . . The private power campaign, the President asserted, is based on the theory of scaring the people with catch-phrases such as "socialism," instead of arguing on the basis of facts.

"What these private power companies are actually doing is deliberately and in cold blood setting out to poison the minds of the people. They make no bones about it. Their own manuals say that their purpose is to influence the mass mind in this country by playing on people's emotions.

"The 'mass mind'—what a horrible phrase. . . . They think of the individual human beings in this great country as parts of a mass mind. They set out to play upon the emotions of churchgoers, Boy Scouts, and school children. They try to control people's thoughts by using slogans and scare words.

"They have taken a leaf right out of the books of Karl Marx and Adolf Hitler. They are following the Soviet and Fascist lines."

He then held up the Niagara ad, paid for in this case by Wisconsin Power & Light Co.

Investment for People . . . "They try to make you believe," he commented, "that the power companies would like to build—control the power at Niagara Falls, and do it in the public interest and without any cost to the public. Now, if you believe that, you are more naive than I think you are.

"They don't stop to think that an investment of the Federal Government in a proposition of that kind is an investment for the people of the whole United States. And it is an investment and a self-liquidating investment.

"Now, I don't object to the power companies making a profit, but I do object to their skinning the life out of the people. In this ad here, they don't say anything about profits. They imply that if the private power people could build this, there wouldn't be any cost to the public at all."

Two Sets of Figures . . . The President made another charge. He said utilities had one set of figures on which they paid taxes, and another set, four or five times as great, on which they based their rates. When he was running the county back in Missouri, he said, he tried to get the Legislature to see that rates and taxes ought to be on the same figures. But, he asserted, the private companies had too big a pull in the legislature, and so he could not get it done.

"People's Utility" . . . Murray D. Lincoln, president of the Farm Bureau Insurance Companies and chairman of the conference, tossed aside the kid gloves in a keynote address. Departing from his prepared speech, he said, "We must get on the offensive and take the power industry over on a legal basis."

He noted this had already been done in some farm areas and called on the conference to let the REA co-ops serve as an example for the cities. He also suggested a consolidation of small REA co-ops with larger ones to form one vast "people's utility."

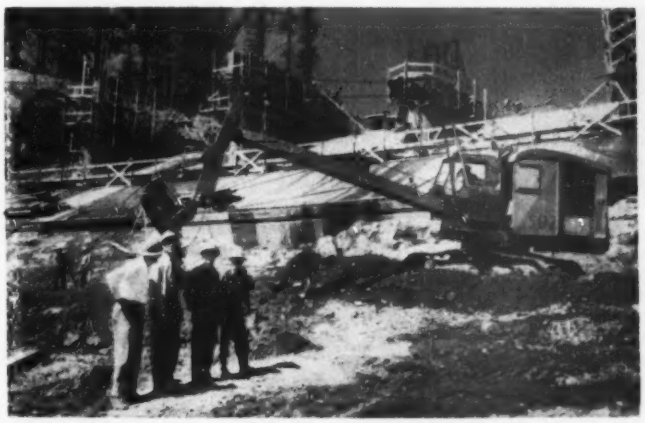
This was in conflict with a part of his prepared speech, which he also read to the conference: "We are not against private power companies nor do we intend to be maneuvered into a position where we can be said to oppose their being in business as they oppose our rights to get the electricity we need in the way that is best for us."

But again talking extemporaneously, he said, referring to the power companies: "Let's put on our coats. Tell our story to the people. Then go ahead and take them over. This is not socialism, but the ultimate of free enterprise."

NAEC Head Scored . . . One of the main purposes of the conference was to organize a fight against the lobby of the electric companies. Purcell Smith, president of the National Association of Electric Companies, was plainly the scapegoat of the conference. Sometimes speakers referred to him by name, but more often they referred to him as the "$65,000-a-year lobbyist."

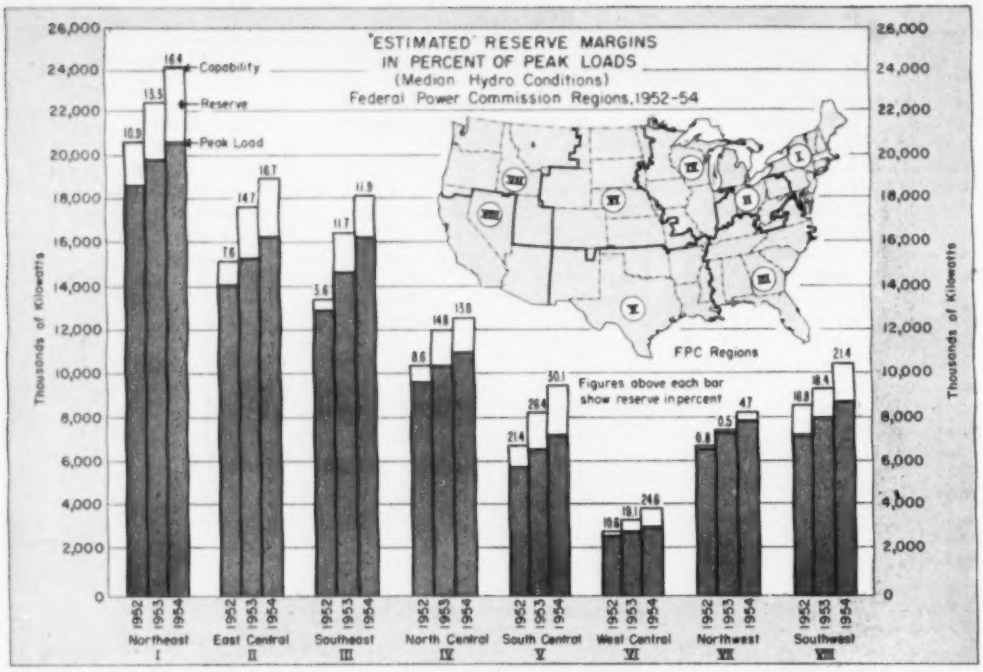
While the conference sought to stress the consumer angle, it was run in large part by those who have a vested interest in federal and other forms of public power. National Rural Electric Cooperative Association, lobby group for the co-ops, landed two men on the nine-man "committee on principles." This group was selected the first day of the conference to work out a policy statement.

American Public Power Association had a man on the committee as did the Tennessee Valley Public Power Association. There was one representative each from the California State Grange, the Farmers Union, an AFL union, a CIO union, and the Public Affairs Institute.



Greek Engineers Visit Yale Project

American methods of power plant construction are studied by visiting Greek engineers at Pacific Power & Light Co's Yale hydroelectric project on the Lewis River in Washington. J. B. McKamey (left) project engineer and George Henderson (right) resident engineer, show visitors George Kalkanis and John Moraitis around the project.



EEI Forecasts 9.2% December Reserve

Figure on capacity margin, lowest predicted in three years, set in 11th Semi-Annual Electric Power Survey

The nation's power suppliers will have a reserve of only 9.2%, the lowest in three years, this coming December. This is the forecast of the Electric Power Survey Committee of Edison Electric Institute, whose Eleventh Semi-Annual Electric Power Survey was made public this week.

This forecast could be on the high side because it is based on these two assumptions:

1. That this will be a year of median hydro conditions.

2. That capability will be increased 8,890,000 kw this year.

The chances of this being a median (or even better) hydro year are very good. The chances of the healthy increase in capability are slim. Right now it appears as though from 1.5 million to 2.5 million kw will slip over into 1953.

On the other hand the committee's reserve forecast may be low. It is also based on the assumption that peak will be 77,505,000 kw, 9.7 million kw above that of last December. If business slumps this could be less.

The 9.2% reserve or gross margin forecast is a sharp drop from the 11.8% achieved last December. This was 1.5% increase over the 10.3% reserve of December 1950. Forecasts for the coming years are 14.0% for 1953 and 16.2% for 1954.

The '53 and '54 forecasts are based on respective capabilities of 96,708,000 and 105,791,000 kw and peaks of 84,807,000 and 91,055,000 kw.

While the nationwide picture is less bright, that of the regions is much brighter than it was a year ago. Then deficits were anticipated for December 1951 in the Southeast and Pacific Northwest. Neither deficit materialized. This year under median hydro conditions the only deficit forecast is a minor one, 2% in the Western Division of the Northwest. This could be covered by the Eastern Division. The walloping 21.4% reserve in Region V is due to this region's summer peak.

The "slippage" anticipated in coming on-the-line schedules is that predicted last year by industry men serving with mobilization agencies in Washington. The industry did not get all of the materials it needed. As it takes many months to build power plants and equipment, this material shortage is just beginning to show up.

Furthermore, the manufacturers have their schedules drawn so tightly that the least delay in manufacture will cause "slippage." And delays can be caused by the weather, labor trouble, accidents, late arrival of material, and a number of other unforseeable, unpredictable, and unavoidable events. It must be remembered also that in most cases "slippage" is caused by the late arrival or construction of but a small part of a plant or its equipment.

One bit of good news is that in the past few months the materials situation has improved to a point that there should be no "slippage" in the coming year because of it.

BPA Report

Power agency says addition of 7.5 million kw needed in next ten years in Northwest

New generation of 750,000 kw every year for the next ten years will be needed in the Pacific Northwest to meet existing power deficiencies and provide for load growth, according to Bonneville Power Administration's 1952 advance program.

"On schedule" completion of dams now under construction, additional needed projects in the Columbia and Snake River basins, steam plants and Oregon-Idaho and Oregon-California transmission interconnections are listed as key factors in meeting regional power needs to 1960-61.

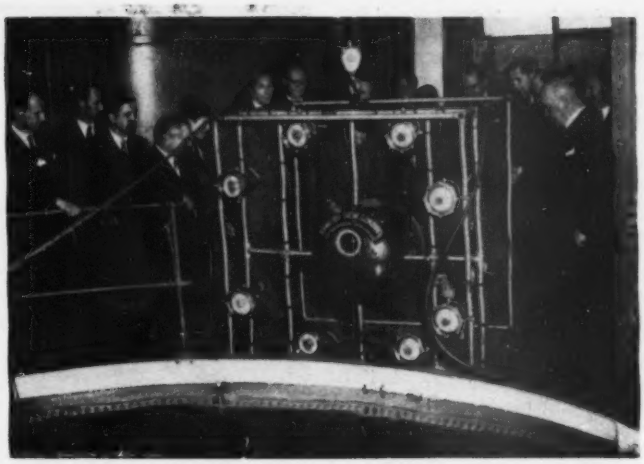
To support this program, BPA estimates, an annual federal investment of some $250 to $300 million will be needed.

Deficit Seen . . . BPA Administrator Paul J. Raver said that the Pacific Northwest faces an estimated regional average deficit during this year's drawdown period of more than 600,000 kw, including interruptible sales.

Noting that the current defense generation schedule "U" federal project development program recommended by BPA, Bureau of Reclamation and Army Corps of Engineers calls for a Columbia River power system with a prime capability of nearly 7 million kw by 1960-61 and that non-federal power installations scheduled through 1955-56 would add some 722,000 kw of prime power, the advance report said that, even if these schedules are followed, power will remain critically short for at least the next two to five years. And, the report adds, the Columbia River power system would not be able to provide all requirements for new industry at any time during the next ten years.

Two proposed dams, Ice Harbor and Hells Canyon, are listed as the most urgently needed projects, aside from those under construction.

The report lists the major engineering task confronting BPA in the next ten years as the designing and construction of an expanded transmission grid capable of carrying a total of almost 9.5 million kw from 31 large and small generating plants scheduled to be in operation in 1961 to load centers in the Pacific Northwest area.



New Underwater TV Camera . . .

Marconi's Wireless Telegraph Co, Ltd

. . . Could Inspect Submarine Cables

Close inspection of submarine cables and other underwater equipment is a possibility offered by development of two undersea television cameras in England. The two cameras, although similar, were developed separately by Marconi's Wireless Telegraph Co, Ltd, in cooperation with Siebe, Gorman and Co, Ltd, and Messrs Pye Ltd.

Both developments consist of a standard television camera adapted for underwater use. The Marconi-Siebe, Gorman apparatus (see photographs) is an image orthicon type with special adjustments for remote focus control, remote iris control, an inclinometer and a moisture detection indicator all mounted in a watertight housing. This in turn is mounted on a pipe framework with eight 150-w lamps.

The experimental camera has been tested to 600 ft. The company says it is capable of satisfactory operation at 1,000 ft. In recent demonstrations, the camera proved to be more sensitive than the eye in 13 ft of dirty fresh water.

Equipment developed by Pye consists of a modified standard television camera with built-in facilities for changing lenses, focus and aperture under water by remote control. This

apparatus has a maximum visual field of 70 deg. A large fin on the exterior of the casing serves to steady the camera and as a mount for lighting equipment. This camera is also designed to reach depths of 1,000 ft.

The Marconi-Siebe, Gorman equipment was used about a year ago to identify a submarine sunk in the English Channel. W. R. Stamp of the Admiralty Research Laboratory, who took part, said later:

"In 280 ft of water, 10 miles off the coast, visibilities up to 40 ft were obtained . . . a range of 15 ft being the minimum. . . . Coastal waters are often of mediocre quality, and much water is opaque and useless for (underwater) television."

Sharp Increase Forecast in Iowa Power Needs

Power requirements in the 77 Iowa counties in the Missouri River Basin will nearly triple in the next 18 years, but planned expansions will keep supplies ahead of the demand.

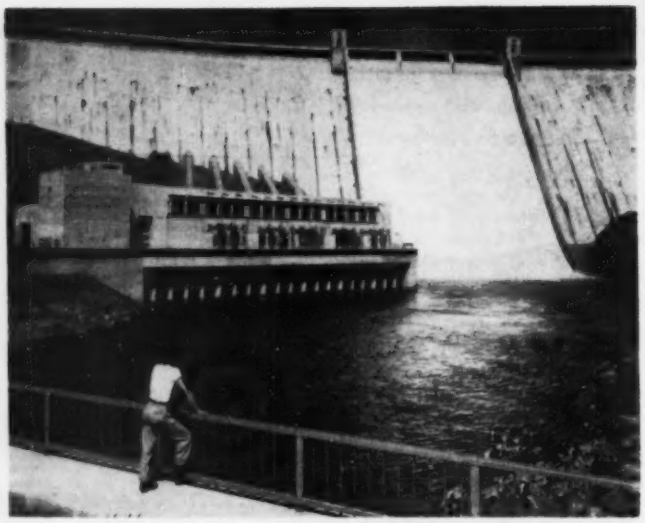
That was the gist of a report handed Iowa Gov Wm. S. Beardsley by the Iowa Electric Power Committee after a five-month study of investor-owned, municipal, and Rural Electrification Administration utilities in the basin counties. The committee was appointed by the governor to fulfill a request of the Missouri Basin Inter-Agency Committee.

Bernard F. Nowack, assistant director of the Iowa Development Commission, headed the committee which was composed of representatives of the three types of power suppliers.

Although based on existing conditions, the report did not preclude use of Missouri River Basin hydro electric power from planned projects, Nowack said. He said plans for expansion could be modified to absorb the hydro power after its quantity, cost, and characteristics had been determined.

The committee estimated power demands for the 77 counties for industrial, agricultural, and domestic use at 733,400 kw at the end of 1952 against a generating capacity of 770,000 kw. By 1955, demand was expected to rise to 936,200 kw and capacity to 1,068,700 kw. By 1970, the report said, demand will be 2,129,700 kw and capacity 2,225,800 kw.

The survey was the first comprehensive study in Iowa of power supplies and needs for all uses.



WATER POURS over the spillway drum gates at Shasta Dam as Shasta Lake filled to its 4.5 million acre-ft capacity last month for first time since dam went into operation in 1943

Teaming Up to Beat Floods

Army Corps of Engineers, Bureau of Reclamation take steps to hold record spring run-off in West in check

Coordinated planning by the Army Corps of Engineers and the Bureau of Reclamation aims to prevent or alleviate flood damage in the western states this spring.

Reclamation reservoirs with outlet capacity sufficient for major flood-control effect are being operated in conjunction with extensive flood control plans of the Corps of Engineers. Other Reclamation reservoirs, designed for irrigation and power purposes, are being lowered to hold back as much of the waters from run-offs as possible. These reservoirs—of minor value in a major flood—help check flood waters on their way downstream.

In the Rio Grande watershed, Reclamation's Platoro Reservoir is being operated in conjunction with the Albuquerque district office of the Corps of Engineers to control the peak flow downstream.

Joint Operations . . . Other joint operations of the Engineers and Reclamation include: Grand Coulee Dam on the Columbia River, Anderson Ranch on the Boise, and Shasta Dam on the Sacramento in the Central Valley Project.

Pine Flat Reservoir, a partially completed corps project, is being used in close conjunction with Reclamation's Friant Reservoir in an effort to reduce flood damage along the San Joaquin.

Private utilities in the West are ready to take whatever action is necessary to prevent or lessen the effect of floods, but at the end of last month did not have to spill water at their dams to make room in their reservoirs for the record run-off.

Shortage of Cooling Water . . . Utah Power & Light Co is having no hydro surplus trouble even though Utah is suffering from the worst floods in its history. Paradoxically, the utility is threatened by a shortage of cooling water for its Jordan steam plant.

In Salt Lake City, flood control engineers took most of the stream flow of the Jordan River from its bed, fearing it could not safely take the run-off. Jordan plant gets cooling water from the river.

Pacific Gas & Electric Co so far has not sacrificed any hydro production. It is getting maximum utilization out of its hydro facilities but expects some spillage since run-off is greater than the system can handle.

U.S. Team Visits British Power Plants

17 American utility experts gain useful experience from tour of BEA electric facilities

The 17 American utility experts who toured Britain's utility industry earlier this year were much impressed with what they saw.

The American team made the six-week trip under the sponsorship of the Mutual Security Agency and the Anglo-American Council on Productivity. During their visit, the members covered 2,600 miles, and visited all the 14 Area Boards of the British Electricity Authority in England, Scotland, and Wales.

Useful Experience . . . Summing up the team's impressions, Chandler W. Jones, vice president, Narragansett Electric Co, Providence, R. I., the group leader, said the team had found British technical and engineering skill to be excellent and had gained some useful experience.

In particular, Jones made reference to the British researches into coal and the methods of burning low-grade fuel. This, he stated, might have application in some parts of the United States.

Another practice which was new to the team was the use of radioactive cobalt and supersonic testing for cracks in metals.

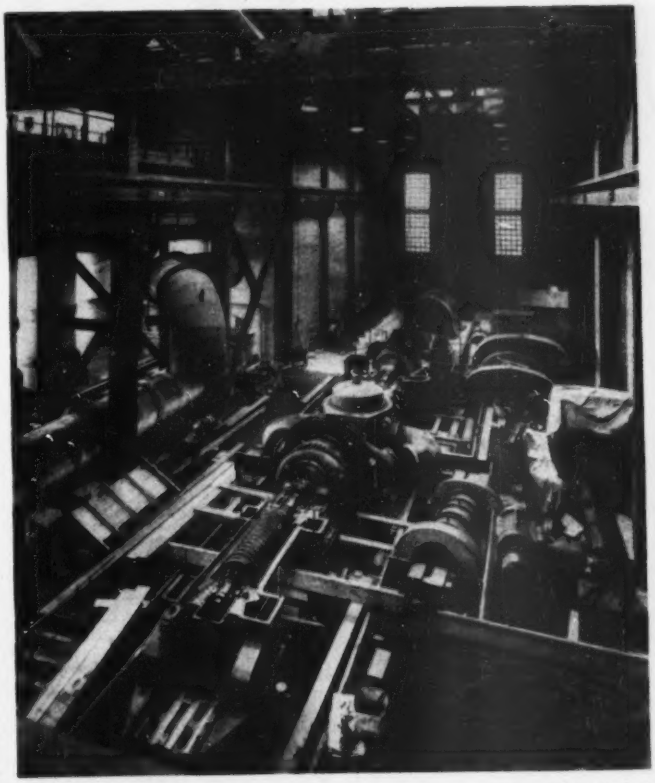
Floyd L. Goss, Department of Water and Power, Los Angeles, Calif., considered that Britain was ahead of the U. S. in design of underground cables.

Another member of the team, J. C. Falkner, Consolidated Edison Co of New York, was particularly interested in the use of aluminum roofing and glass sides in British power station construction.

Gas Turbine Unit . . . One of the highlights of the tour was a visit to the Trafford Power Station at Manchester where a 15,000-kw gas turbine generator is being erected. Over six tons of air a minute will pass through the generator.

A self-contained unit, the generator needs no boiler plant, can run up to full load in a matter of minutes, and requires only about a third of the cooling water needed for some steam turbine plants.

TOUR OF CONTROL ROOM at Manchester is conducted by regional manager of British Electricity Authority. Power distribution to 27-mile area is controlled from this room



GAS TURBINE GENERATOR being erected at Trafford Power Station proved particularly interesting to American utility experts. The 15,000-kw unit is larger than any in U. S.

PUBLIC RELATIONS & ADVERTISING

Can America Escape Socialism?

This June advertisement of the Electric Companies Advertising Program not only asks the above question but also answers it. The ad advises that one must first be able to recognize hidden socialism. The clue is the old line, "Let the federal government do it—or run it—or take it over—or own and operate it." Then once recognizing these steps leading to socialism, any American can help America escape it by helping his friends and neighbors to see the danger and by using his ballot wisely. This advertisement is scheduled to run in "Colliers," June 7; "U. S. News," June 13; "Saturday Evening Post," June 14; "Successful Farming," and "Country Gentleman," June.

ANNUAL REPORT HIGHLIGHTS

Oklahoma Gas & Electric Co reports that voters in 14 Oklahoma cities, including Oklahoma City, renewed 25-year company franchises by votes that were 97% favorable . . . **Toledo Edison Co** has good colored charts, a feature page on "News of the Year in Pictures," and an excellent summary of the past ten years . . . **West Penn Electric Co** set aside a page to show six of its outstanding ads used during the year to bring industry into its area.

Wisconsin Power & Light Co has "plenty" for a theme. "You are entering the 'Land of Plenty'—plenty of prosperous industries—plenty of productive farms—plenty of electric power." . . **New England Gas & Electric Association's** report is the "Silver Anniversary" issue.

'Howdy Neighbor,' Says Pennsylvania P&L Co

When Pennsylvania Power & Light Co announced that it was going to erect a 132,500-kw steam plant at Martins Creek, along the Delaware River, company officials felt that they should meet their new neighbors.

They met them on "Howdy Neighbor Night." The place was the auditorium of the consolidated school at Martins Creek. Some 500 residents of the area showed up to hear talks by Pres Charles E. Oakes; Vice Presidents J. C. Knowles and George M. Keenan; the project manager and his assistant; and the plant superintendent. Company officials also answered questions asked by the audience.

A color motion picture of the construction of the company's Sunbury Plant was shown. Special displays illustrated the company's postwar growth of generating capacity and electricity's role in our nation's "Production for Freedom."

AD COPY THEMES

Boston Edison Co—"Electricity Keeps Its Postwar Promise" was headline on advertisement showing how New England companies had increased their capacity from 2,659,000 kw in 1945 to 4,377,000 kw in 1952, a 64% increase. Light bulbs drawn in proportion were used for illustration.

Central Power Light Co—"Will they inherit socialism?" is the question used as a headline for an ad pointing out that the two children illustrating the ad might inherit a socialistic America. It states that socialism wears many false faces and goes on to explain how socialism can be detected.

Hartford Electric Light Co—Reddy Kilowatt was shown laboring under a burden of an 91% wage increase since 1939, a 107% coal increase, and a tax increase of 165%. Reddy was walking along a line showing the BLS Consumers Price Index at 100. Ahead of him a line marked, "Cost of Living," rose to 190 and a line marked, "Cost of Electricity," decreased to 80. The ad pointed out for the first time in 30 years the company had to seek a rate increase.

FINANCIAL

Stable Economy in '52: Sporn

AG&E head expects civilian activity to be at lower level than in '51 but sees continued rise in military production

Outlook for 1952 appears to be for "generally stable civilian activity" but a somewhat lower level than experienced in 1951, American Gas & Electric Co's Pres Philip Sporn told shareowners at the annual meeting recently. This is offset, he said, "to a large extent by a continued rise in military and military induced industrial production, although at a less rapid rate than has been the case at any time till now, since Korea."

There has been some talk recently, he declared, that the industry is overbuilding, and adding more capacity than will be required in next few years. Without commenting on the industry capacity picture, he said, there are no indications of any substantial overbuilding on the American Gas & Electric Co system.

Detailed System Load Estimates . . . For some time the system has carried on carefully detailed estimates of system load running several years into the future. These estimates are continuously revised as new information becomes available. They have proven to be highly accurate guides in the planning of system expansion. In fact, he pointed out, the longer term estimates have usually been on the low side because of new loads which develop during the period over which the estimates are made.

He said it is true that the rise in electric demand has developed some softness in recent weeks. "We are studying this now and this study may show a reduction in our 1954 peak demand of even as much as 200,000 kw," he declared. But this would still not result in excessive reserve, he continued, particularly when we may at any time face full mobilization of our national resources and with it a very heavy increase in the demand for electric power.

Earnings are less readily predicted, he said, but if the company continues at the present rate earnings of between $4.75 to $5.00 per share could be realized. This is on the basis of the full number of shares now outstanding—over 5,706,000 common shares.

Securities to Be Sold . . . On April 30, the company announced that it would sell about $30 million in securities. These will include $20 million in sinking fund debentures, and 170,000 additional shares of common stock. Because of the small number of shares to be sold in relation to the shares now outstanding, he said, the company is not offering the new shares to shareowners on a rights basis. They will be sold via competitive bidding to underwriters, who will make a public offering. The implementation of this program is, he said, subject to Securities and Exchange Commission final approval.

When it gets this approval, it will be first time since the passage of the Holding Company Act of 1935 that the company has been able to raise new money through the sale of debentures. The new financing plans, he pointed out, will help the company to offset in some measure the increasing costs of operation, and the increased burden of federal income taxes, and at the same time avoid excessive dilution of the shareowners' equity.

The following four proposals received an affirmative vote of more than 66⅔% of the total shares outstanding and were adopted: Annual election of directors; preemptive rights to shareowners; cumulative voting rights, and authorized but unissued preferred stock to be changed to additional common stock.

FINANCIAL BRIEFS

Florida Power & Light Co stockholders have approved a $35-million preferred stock issue, Pres McGregor Smith reports. He said that by 1961 the company will have a capacity of over 1.4 million kw compared with 210,000 kw on V-J Day and 500,000 today.

Middle South Utilities has asked Securities and Exchange Commission approval to borrow $15 million from banks . . . General Public Utilities Corp is planning to open an office in Reading, Pa., Pres A. F. Tegen has revealed.

American Power & Light Co has omitted common stock dividend normally due at this time as "It is the intention not to pay further dividends from surplus earnings but to make only distributions in liquidation."

Colorado Central Power Co has received Public Utilities Commission approval to sell $700,000 in 4¼% sinking fund debentures due 1963 to Northwestern Mutual Life Insurance Co.

Halsey Stuart & Co has asked a House Commerce subcommittee to recommend legislation requiring privately placed securities to be registered with the Securities and Exchange Commission.

REGULATION

Public Service Co of New Hampshire has been granted a rate increase of about $1.3 million per year, including a $700,000 temporary increase authorized by the state commission last fall. The company had asked for $1.6 million.

Empire District Electric Co has received Missouri Public Service Commission approval to increase rates by $527,974 per year. Kansas State Corporation Commission has also granted rate increases of $91,550 a year more on Kansas operations. If similar increases are granted in Arkansas and Oklahoma, a company statement said, the gross annual revenues of the company for the entire four states in which it operates will be increased $735,837 as compared with a requested annual increase of $800,000 for the entire system.

Missouri's Gov Forrest Smith has appointed Maurice W. Covert a member of the Public Service Commission, succeeding Kyle D. Williams, resigned.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1952									
May 22	2.94	2.98	3.10	4.00	4.21	4.56	5.31	5.88	6.48
May 15	2.94	2.98	3.08	4.03	4.23	4.57	5.34	5.96	6.56
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47
4th 1951	3.02	3.07	3.21	4.32	4.50	4.91	5.42	6.18	6.84
3rd 1951	2.87	2.91	3.04	4.05	4.27	4.61	5.52	6.24	7.05
2nd 1951	3.02	3.11	3.23	4.11	4.37	4.68	5.73	6.38	7.37

Data: Reis & Chandler, Inc.

EARNINGS

Company	PERIOD Months	Ended	Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Central Illinois Light	12	April	$5,117,726	$3,096,895	$2.91(a)	$2.88(a)
Cincinnati Gas & Electric	12	Mar.	10,435,580	9,064,391	2.82(a)	2.91(a)
Detroit Edison	12	April	15,659,393	16,444,115	1.64(a)	1.85(a)
Minnesota Power & Light	12	April	3,278,750	3,507,704	3.15	3.41
Ohio Edison and subsidiary	12	April	14,471,139	14,362,916	2.71(a)	2.97(a)
Pennsylvania Power	12	April	1,959,635	1,629,040	.....	.....
Portland General Electric	12	April	3,563,274	3,405,567	2.80(b)	2.72(b)
Southern Indiana Gas & Electric	12	April	1,740,023	1,921,366	1.94	2.20
Virginia Electric & Power	12	April	11,327,647	10,207,400	1.78(b)	1.85(b)
Wisconsin Electric Power	12	Mar.	8,372,004	7,746,623	2.04	1.86

Notes—(a) On shares outstanding at end of each period; and (b) On average number of shares outstanding during the period.

FINANCING

Company and Description	Amount of Offering ($000)	Offering Price	Yield to Public
WEEK OF MAY 22-28			
Preferred Stock			
Dallas Power & Light—100,000 sh 4.24% no par	$10,000	$102.50	4.137%
Long Island Lighting—100,000 sh 5% $100 par	10,000	100.00	5.00
Common Stock			
New England Electric System—920,573 sh (being offered to commonholders on 1-for-8 basis, record May 8 to expire May 26)	$11,622	$12.625	7.13%
Iowa Power & Light—226,835 sh (being offered to commonholders on 1-for-7 basis, record May 14 to expire May 28)	4,822	21.25	6.59%
WEEK OF MAY 29—JUNE 4			
Preferred Stock			
Tampa Electric—50,000 sh $100 par	$5,000	.....	.....
Common Stock			
Wisconsin Electric Power—702,486 sh (being offered to commonholders on 1-for-5 basis (a), record May 6 to expire May 29)	$14,050	$20.00	6.50%
Central Vermont Public Service—108,900 sh (being offered to commonholders on 1-for-6 basis, record May 19 to expire June 3; New England Public Service, owner of 35.5% of common waives its subscription rights)	$1,334	12.25	6.53%
Tampa Electric—60,000 sh	.....	.....	.....
Northern States Power (Minn.)—1,108,966 sh (to be offered to commonholders on 1-for-10 basis (a), record June 5 to expire June 23; price will be determined by competitive bidding)	.....	.....	.....
SCHEDULED FOR JUNE			
Bonds			**Bid Date**
Kansas Gas & Electric—1st mtg 1982	$12,000	.....	June 10
Northern States Power (Minn.)—1st mtg 1982	21,500	.....	June 10
Rochester Gas & Electric—1st mtg 1982	6,000	.....	June 11
Central Louisiana Electric—1st mtg 1982	4,000	.....	June 12
Boston Edison—1st mtg 1982	16,000	.....	June 17
Kentucky Utilities—1st mtg 1982	12,000	.....	June 17
Public Service Electric & Gas—debentures 1972	40,000	.....	June 17
American Gas & Electric—debentures 1977	20,000	.....	June 18
Gulf Power—1st mtg. 1982	7,000	.....	June 24
Public Service Co of Indiana—1st mtg 1982	25,000	.....	June 25
Preferred Stock			
Public Service Co of Indiana—800,000 sh $25 par	$20,000	.....	(b) June 17
Common Stock			
Virginia Electric & Power—494,642 sh (being offered to commonholders on 1-for-10 basis (a), record May 23 to expire June 9)	$10,758	$21.75	8.44%
Kansas Gas & Electric—200,000 sh	.....	.....	June 10
American Gas & Electric—170,000 sh	.....	.....	June 18
Southern Co—1,004,510 sh (to be offered to commonholders on 1-for-16 basis, record June 19 to expire July 10; company will set stock price; underwriters will be selected by competitive bidding on compensation)	.....	.....	June 18
Pacific Gas & Electric—2,271,300 sh (to be offered to stockholders on 1-for-5 basis, record June 10 to expire July 2)	.....	.....	.....
Public Service Electric & Gas—700,000 sh	.....	.....	(c) June 11

Notes—(a) Stockholders allowed oversubscription privileges; (b) Blyth & Co, underwriters; and (c) Morgan, Stanley & Co group, underwriters.

CALENDAR

C.I.G.R.E.
(International Conference on Large Electric High-Tension Systems), 14th Biennial Session, Paris, France, May 28-June 7.

Edison Electric Institute
20th Annual Convention, Cleveland Public Auditorium, Cleveland, Ohio, June 2-4; Accident Prevention Committee, Sheraton Hotel, Rochester, N. Y., Sept. 15-16; Prime Movers Committee, Roosevelt Hotel, St. Louis, Mo., Oct. 6-7; Electrical Equipment Committee, Roosevelt Hotel, New York, Oct. 13-14; Transmission-Distribution Committee, Hotel Adolphus, Dallas, Tex., Oct. 23-24.

National Association of Electrical Distributors
44th Annual Convention, Hotels Ambassador-Chelsea, Atlantic City, N. J., June 9-12.

International Organization of Standardization
Triennial Meeting, Columbia University, New York, June 9-21.

Pacific Coast Electrical Association
Annual Convention, Hotel del Coronado, Coronado, Calif., June 11-13.

American Society of Mechanical Engineers
Semi-Annual Meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio, June 15-19; Fall Meeting, Sheraton Hotel, Chicago, Ill., Sept. 8-11.

National Association of Corrosion Engineers
Short Course on Corrosion sponsored jointly by Cleveland Section of NACE and Case Institute of Technology at the institute, Cleveland, Ohio, June 16-20.

Illuminating Engineering Society
Northeastern Regional Conference, Hotel Preston, Swampscott, Mass., June 19-20; National Technical Conference, Edgewater Beach Hotel, Chicago, Ill., Sept. 8-12.

American Institute of Electrical Engineers
Summer General Meeting, Hotel Nicollet, Minneapolis, Minn., June 23-27.

American Society for Testing Materials
Annual Meeting, 50th Anniversary, Hotels Statler-New Yorker, New York, June 23-27.

National Retail Credit Association
International Consumer Credit Conference, Statler Hotel, Washington, D. C., June 23-26.

Canadian Electrical Association
Annual Convention, Banff Springs Hotel, Banff, Alberta, June 30-July 2.

Maryland Utilities Association
Cavalier Hotel, Virginia Beach, Va., Sept. 5-6.

Rocky Mountain Electrical League
Fall Convention, Colorado Hotel, Glenwood Springs, Colo., Sept. 7-10.

American Standards Association
National Standardization Conference in conjunction with Centennial of Engineering, Museum of Science-Industry, Chicago, Ill., Sept. 8-10.

Public Information Program
Annual Workshop Conference, Edgewater Beach Hotel, Chicago, Ill., Sept. 18-19.

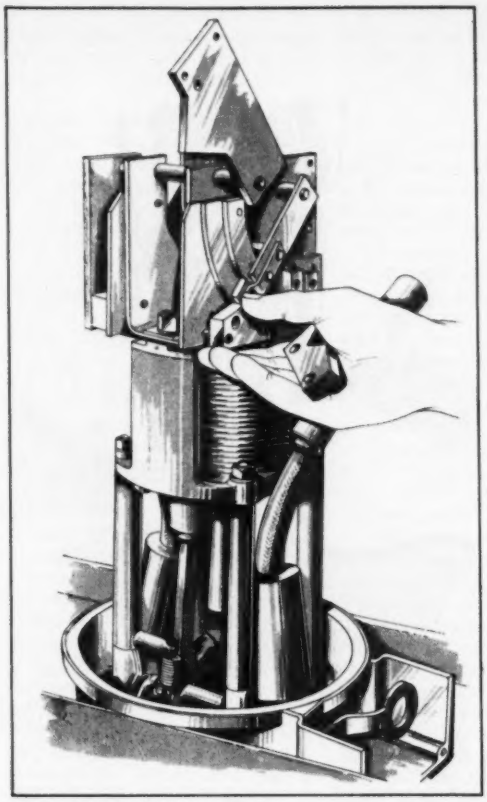
National Electronics Conference
8th Annual Conference, Sherman Hotel, Chicago, Ill., Sept. 29-30 and Oct. 1.

***Wisconsin Utilities Association**
Convention of Technical-Sales Sections, Schroeder Hotel, Milwaukee, Wis., Oct. 1-3.

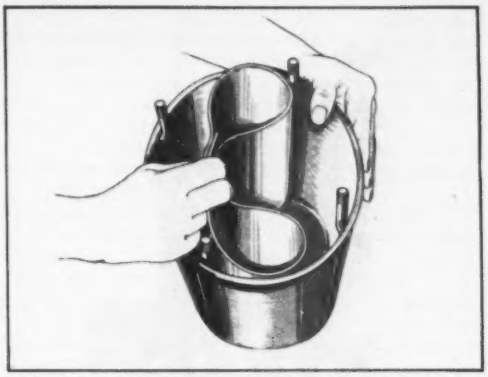
***National Farm Electrification Conference**
Statler Hotel, Detroit, Mich., Oct. 20-21.

***National Electrical Manufacturers Association**
Annual Meeting, Haddon Hall Hotel, Atlantic City, N. J., Nov. 10-13.

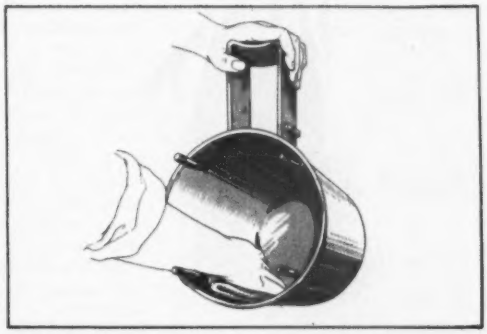
* **Addition this week.**



CHECK MECHANISM to see if contacts close freely, are smooth and free from carbon. If rough and carbonized, contacts need servicing



POUR OUT OLD OIL and inspect tank liner. If liner shows signs of moisture, blisters, or softness at bottom, it should be replaced with a new liner. This is an indication that the recloser may need drying out



CLEAN TANK with new oil and thoroughly wipe out carbon deposit. Refill with oil that has been hi-pot tested, whether new or reclaimed

Reclosers Too Need Maintenance . . .

. . . as they assume a place of greater importance in system operations. Moisture absorption is a major factor. Author discusses factors determining the frequency of maintenance periods and how maintenance should be done

R. C. KIRK, Manager, Kyle Product Sales, Line Material Co, Milwaukee, Wis.

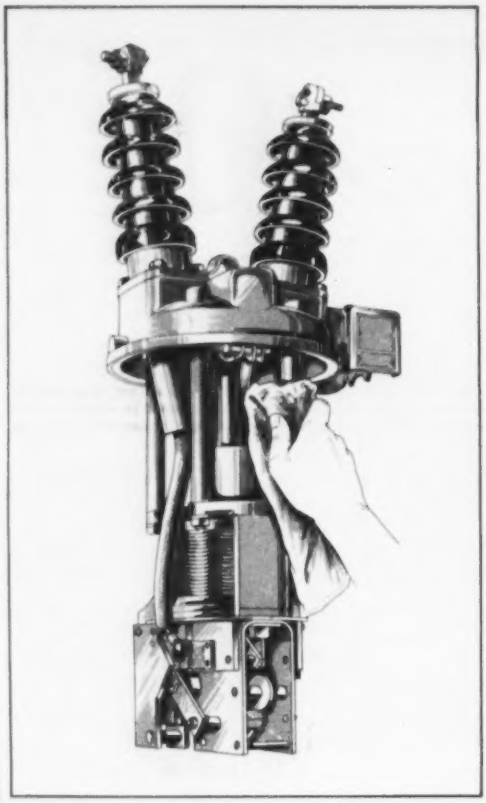
As another lightning season approaches the time is ripe for individual companies to institute a program of recloser and sectionalizer maintenance. This is necessary to prepare the equipment to do a good job of maintaining high standards of electric service.

How often to do oil circuit recloser maintenance is a hard question to answer. A number of factors enter into its determination. Collection of moisture in a recloser, from breathing and oxidation, is a function of climatic conditions, loading, and time. The collection of carbon is, of course, a function of the operating duty, i.e., the number of arc interruptions, magnitude of the current, voltage, and power factor of the fault current. Some of these factors are impossible to determine. Therefore, it is necessary to set up some practical rule to follow.

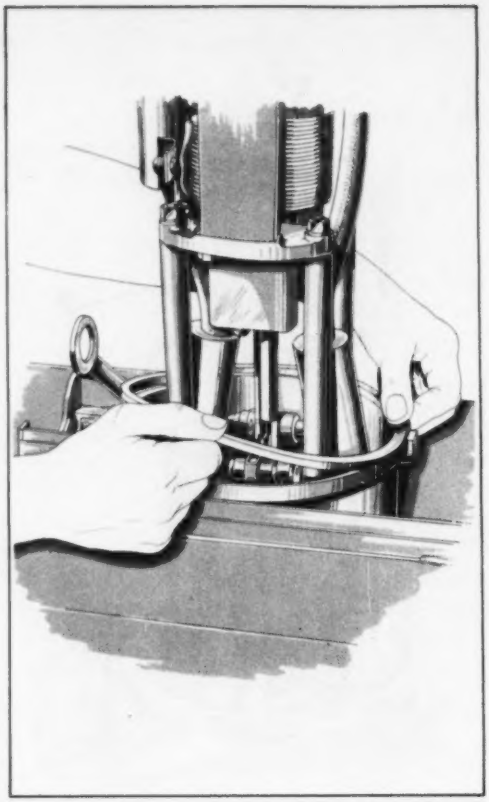
When To Service . . . A good general rule, recognizing both time and average duty expected, is to give each recloser maintenance once a year or after the maximum number of operations given in the following table, depending upon which comes first.

Recloser Rating Amperes	Number of Operations
5	300
10	250
15	200
25	160
35	120
50	100

This table assumes that the faults will be distributed between minimum



CLEAN MECHANISM, removing all carbon traces by wiping with clean, lint-free cloth, paying special attention to all insulating parts. Do not dismantle mechanism unless signs of faulty operation exist



BEFORE MECHANISM IS REPLACED in tank, install a new head gasket to insure a good seal against moisture. Use gasket cement. Sealing can be checked by inverting the complete unit

tripping and maximum interrupting capacity of the recloser and assumes average field duty in this respect. This recommendation is based on laboratory tests and observation of the condition of many units after field service. If all of the interruptions are at or near maximum interrupting rating of the recloser, the above figures should be reduced to approximately 30% of the values in the table. If all the interruptions are light, the figures could be increased substantially. However, as this is done, the time limit is likely to be reached first and become the limiting factor.

A second approach to the maintenance of oil circuit reclosers, regardless of size and number of operations, is at definite one year intervals. Whether the maintenance should be performed annually or at some other interval can be determined only by actual operating experience.

A third approach is to perform frequent maintenance on the large size reclosers and to maintain the smaller ones at less frequent intervals. The reasoning for this approach is three-fold:

1. Failure of the larger recloser affects a greater number of consumers.

2. The interrupting duty on the smaller recloser is much lighter, so carbonization of the oil can be expected to be less.

3. Mileage and time costs associated with maintenance can be expected to be greater on the smaller reclosers because of their inherent greater geographical separations. A practical rule is to inspect the 50-, 35-, and 25-amp reclosers once a year, smaller ones every two years.

Reclosers above a 50-amp rating require more frequent servicing because of their heavier duty. Servicing after one year of service or 75 operations, based on average duty, whichever occurs first, will insure continued good service from the equipment and best service to the customer.

The frequency of sectionalizer maintenance is determined almost entirely by the rate at which the insulation in the unit absorbs moisture. Carbon will become a factor if the sectionalizer is used for a large amount of load switching, but in most cases carbon is not a determining factor. The maintenance period then should be determined in view of the climate in which the sectionalizer is used. For best service in hot humid climates, yearly maintenance may be profitable, while in arid areas the maintenance period may be extended to two or even three years.

Reclosers and sectionalizers in storage for several months may pick up an appreciable amount of moisture from breathing. Therefore, they should

be inspected and the oil changed before placing in service. Care must be exercised to insure proper sealing of gaskets on which seal is broken.

Shop vs Field Repairs . . . There are three methods of recloser maintenance which are in more general use. Each has its advantages and disadvantages.

One method consists of removing the recloser from service, servicing it at the base of the pole, and reinstalling it. This procedure requires a minimum of spare units and a minimum of driving time and mileage. It has a very decided disadvantage in that the work may be done during weather and dust conditions which prohibit getting the best job.

By a second method a spare unit is carried along for each size recloser. A crew replaces a recloser with a spare. The crew then proceeds to the next location. While this recloser is being replaced with a spare, maintenance is performed on the first recloser. This method still has the disadvantages of the work being done under conditions not conducive to getting the best possible job.

A third method is to have a number of spare reclosers on hand and to use these for replacing the reclosers in service. These are then brought to a central point for servicing. This procedure is proving most popular and it has several advantages:

1. Servicing can be done in an equipped repair shop by personnel trained in the servicing of equipment.

2. Replacing of units on the pole can be done by a small line crew and does not require the presence of trained equipment servicemen. This makes for more efficient use of skilled labor and results in a better overall job at a minimum cost.

Maintenance Techniques . . . Maintenance procedure is essentially the same whether the work is done in a shop or in the field. Routine maintenance will consist essentially of the following steps:

1. Inspection—Damage by rocks or bullets may include broken bushings, broken counters, deformed operating handles, and holes in the tanks. At the time inspection is made, data such as counter readings, condition of the contacts, and oil test are recorded to complete the service record on each unit. These data are valuable in determining the course of future maintenance programs.

2. Cleaning—The internal mechanism and tank should be thoroughly cleaned and all carbon removed. A check should be made for traces of tracking on all insulating parts. Carbon and other contamination usually can be removed easily by using clean transformer oil with a lint-free cloth or brush. Generally it is not desirable to dismantle the operating mechanism unless there has been some evidence of mal-operation of the unit.

3. Painting—The tank and other painted parts should be retouched or repainted if the paint has been damaged and metal surface exposed.

4. Insulation—All insulating parts should be carefully checked for indication of tracking or presence of moisture which may lead to eventual failure. Excessive moisture can be removed by drying, or the defective part replaced. The manufacturer's recommendations for drying should be followed to get the best results.

5. Contacts—All current interrupting contacts in the recloser should be inspected for wear, alignment, and pressure adjustment. Details as to proper adjustments must be obtained for the particular recloser being serviced. If contacts are rough or burnt, they should be dressed up or replaced.

6. Oil—Replace oil with a standard insulating oil of proper viscosity and dielectric strength. It is advisable to hi-pot all new or reclaimed oil before using it. Good oil can go bad rapidly if not properly stored and handled. For oil circuit recloser and sectionalizer servicing use oil packaged in small containers. This makes it possible to keep the oil permanently sealed until it is needed.

7. Gaskets—All gaskets on which the seals have been broken should be replaced.

Cleanliness is important. A little foreign matter, such as sand, can prevent the unit from operating properly.

Store spare insulating, fiber, and bakelite parts where they will not collect moisture and dirt.

After servicing make tests to determine whether the unit is operating properly and the insulation level is satisfactory.

Sixty-cycle, hi-pot test may not detect insulation which is well along towards failing but will detect that definitely beyond useable condition.

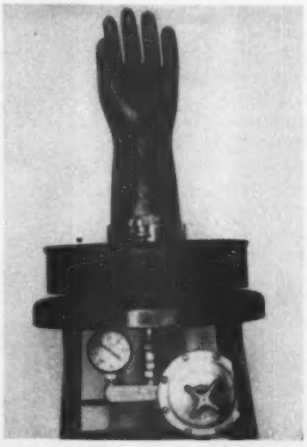
Standards for distribution class oil circuit reclosers specify that new 14.4-kv equipment should have a day withstand of 35 kv for one minute. For reconditioned 14.4-kv reclosers and sectionalizers it is recommeded that the 60-cycle test voltage be increased slowly to 25 kv for one minute and then lowered to zero. This test should be applied two ways:

1. With the contacts open from one bushing to the other bushing and tank with the tank grounded.

2. With the contacts closed from bushing to tank with tank grounded.

The relative condition of the insulation in oil circuit reclosers may be determined by using either dielectric power factor or dc insulation resistance tests. The capacitance in the dielectric circuit in oil circuit reclosers and sectionalizers is very small, and good results cannot be obtained with inexpensive power factor test equipment. The dc insulation test promises to be the most practical method for determining the relative condition of the insulation. The possible value of this type of testing warrants investigation by users of large numbers of reclosers and sectionalizers.

Regulator Limits Pressure In Glove Testing

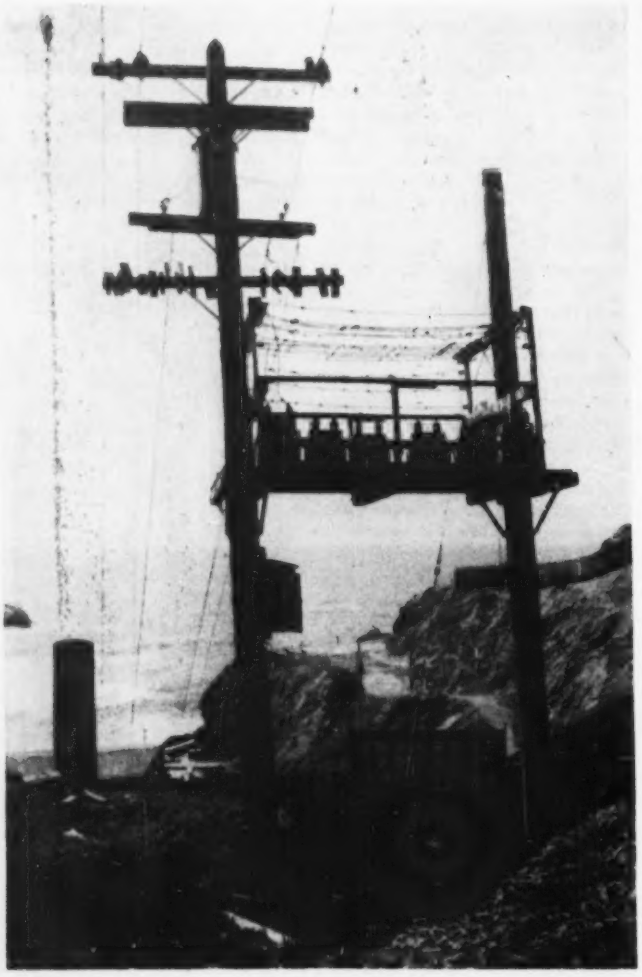


Overinflation of rubber gloves is prevented by a pressure regulator on a glove inflator used by Cincinnati Gas and Electric Co. This feature eliminates high stresses that might injure the gloves mechanically. To test a glove, the operator places it in the socket and turns the rotating valve which pneumatically seals the glove and maintains pressure. The glove can be deflated and removed by rotating the valve in the opposite direction.

Better Connector Life Vital to the

Unsatisfactory performance of present connectors in rural areas removed from coastal contamination indicates the problem may be universal, with location affecting only the timing

C. E. BAUGH,* Electric Distribution Engineer,
Pacific Gas and Electric Co, San Francisco



CONNECTOR TEST RACK set up by Pacific Gas and Electric Co near the Cliff House, San Francisco, for exposure tests on various types of aluminum-to-copper connectors. Rocky shoreline and large breakers give heavy concentration of salt spray. Nearby smoke stack adds contamination, making service conditions at rack site unusually severe for installation

Past experience and the results of recent tests on aluminum-to-copper connectors by the Pacific Gas and Electric Co raise serious doubts as to the advisability of adopting aluminum conductor for urban and industrial areas—regardless of location—until more satisfactory life of connectors is assured.

Discovery of deterioration of aluminum-to-copper connectors revealed by routine inspection in the San Joaquin valley has emphasized that connector trouble is not restricted to sea coast locations. Connectors were affected in significant numbers by corrosion and deterioration after less than three years of service in the Valley, which is removed over 100 miles and two mountain ranges from the ocean—a rich agricultural area where no measurable salt deposits from wind-blown sea water spray have ever been observed.

As a result of this experience and tests later described, the following tentative conclusions have been reached with the hope that more thorough investigation may prove some or all of them wrong:

1. Intimate association of aluminum and any other metal in an electrical connection will lead to trouble if a liquid electrolyte is present in the joint. The degree of trouble depends on strength of the solution, relative position of the metals in the galvanic series, and duration of exposure. Although atmospheric conditions on west coast beaches are admittedly unusually severe, deterioration of exposed copper-to-aluminum connectors has been so rapid as to indicate that similar failures can occur before conductors require replacement for other reasons in any location in the country where atmospheric contaminants are such that an acid, alkali, or neutral electrolyte is formed in the presence of moisture.

2. Contact surfaces of aluminum connectors and conductors must be properly prepared, and the use of non-corrosive greases or other means of preventing oxide formation is essential to the maintenance of low

*Based on paper presented before Transmission and Distribution Committee of Edison Electric Institute, Chicago, May 7, 1952

Use of Aluminum in Distribution

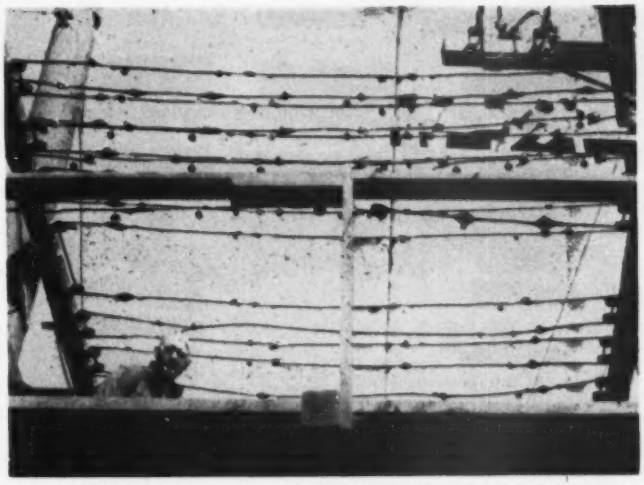
resistance joints. Connectors with aluminum bodies, bolts, etc, should be properly proportioned, taking into consideration the strength of the parts and per unit pressures at which cold flow of the conductor will occur. Tap clamps without spring follow-up are not satisfactory when conductors are loaded to values approaching their thermal limits. Connectors on large insulated cables must be properly proportioned to minimize the effect of cold flow.

3. For general distribution, aluminum-to-copper connections made on bare stranded conductor with parallel groove clamps, U-bolt clamps, split bolt connectors, or any of their variations are unsatisfactory if corrosive agents are present, as there is no practicable way of sealing the joints against entrance of moisture.

4. Copper-to-aluminum joints in neoprene or polyethylene-covered aluminum wire are no problem if a satisfactory method of weatherproofing the joints with tape or otherwise, can be found. Such weatherproofing must have a life comparable to the conductor life. If the conductor covering must be removed from stranded wire at ends or elsewhere, moisture can enter the conductor and travel through the channels between strands into joints unless something can be done to seal off these channels. At the moment we see no practicable way of accomplishing this except at splices.

5. Corrosion in connections on insulated aluminum cable should not be a problem since such connections must be carefully insulated and moisture must be excluded. However, the effect on rubber and rubber-like insulating compounds of inhibited greases used to prevent oxide formation must be considered. PG&E experience indicates that highly refined vaselines tend to dissolve neoprene sheath materials and the adhesive surfaces of tapes.

6. Use of aluminum tubing, bus bar, or stranded wire in outdoor substation construction entails the use of numerous aluminum-to-copper connections at disconnecting switches, circuit breakers, transformers, and other apparatus. Tapes and similar coverings do not seem to fit the imperative need for a practicable method of excluding moisture from these joints.



CONNECTORS INSTALLED in a continuous loop between short lengths of No. 4 stranded aluminum, carried about 40 amp from a current transformer. Most of these 66 connectors were installed in June 1951 and removed when 30 others were added in March of 1952

Aluminum-aluminum OK . . . PG&E's 50 years of experience with aluminum in high-voltage transmission, and more recently in rural distribution, indicates that aluminum-aluminum connections of all types are fairly satisfactory. Principal problems of the user are selection of properly proportioned connectors, initial removal of oxide films, long-time maintenance of oxide-free contact surfaces, and—most important—training personnel in the proper techniques of installation and maintenance.

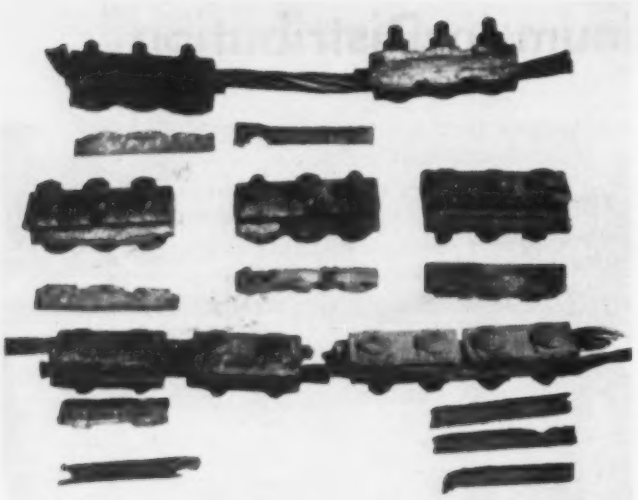
PG&E laboratory tests have established that compression splices filled with an inhibited grease have a better long-time resistance characteristic than when red lead or zinc chromate is used. They have also shown that greases do not have an adverse effect on the holding power of compression splices.

Since the end of World War II, PG&E has used large quantities of ACSR from 4 to 1/0, and all-aluminum from 4/0 to 336,400 circ mil for rural distribution lines, because of the increasing price advantage and overall economies resulting from long span rural construction with ACSR. Trial installation of ACSR in rural areas prior to the war indicated that the problems of fittings for aluminum conductor would not be too serious if its use could be confined to areas where the atmosphere is not contaminated with significant quantities of salt-water spray or industrial fumes.

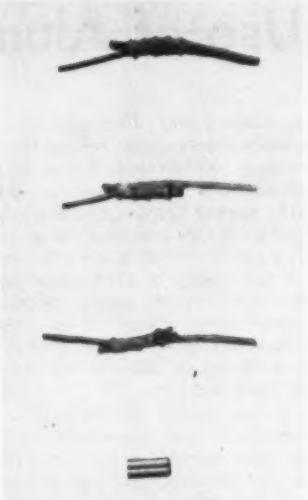
No ACSR conductor has been installed on distribution lines in coastal areas in the system, because of the expected rapid corrosion of the galvanized steel core and the fear that life of fittings now available for copper-to-aluminum connections would be entirely unsatisfactory under salt spray conditions. ACSR transmission lines were extended into beach areas for the first time in 1951, and data is not available on which to base a prediction of performance.

New Areas, New Problems . . . Recently, increasing availability and decreasing price of aluminum have forced the consideration of its use

For Examples of Connector Deterioration Experienced—Please Turn



NO SALT SPRAY CONTAMINATION has ever been observed where these three-bolt aluminum body parallel groove clamps with soldered copper liners were installed in the San Joaquin Valley, over 100 miles inland. They are 9 of 25 found defective during a routine inspection after less than three years of service. Bodies are cracked or broken on the copper side, apparently from decomposition and growth of solder attaching the liners



CADMIUM-PLATED COPPER compression sleeves on uncovered, solid aluminum-copper connections had aluminum half eaten away at sleeve ends; plating in bad condition. Waxed, tin-coated sleeves had strands eroded

Aluminum-Copper connections prove short lived in West

for distribution in urban and industrial areas. Since the two largest urban and industrial areas served by PG & E are San Francisco and Oakland, both on the saltwater San Francisco Bay, any significant extension of the use of aluminum in distribution automatically posed the problems of salt spray and industrial contamination.

The use of aluminum on distribution also posed many problems that are non-existent or of small moment on transmission and subtransmission circuits. Most important of these stem from the multiplicity of copper-to-aluminum joints and taps resulting from the many associated devices such as transformers, cutouts, lightning arresters, capacitors, service restorers, sectionalizing switches, and service connectors, each requiring a transition from aluminum to copper at some point. Atmospheric conditions naturally associated with urban and industrial areas further aggravate the problem.

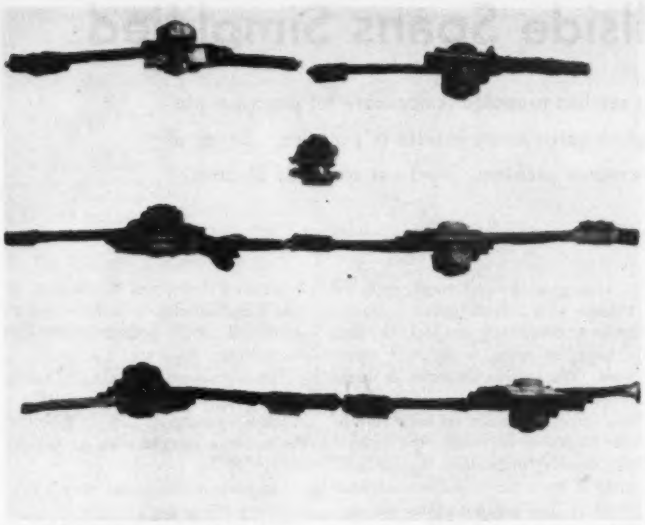
The problem of making aluminum-to-copper connections seems to be one of making the connections in such a manner that conducting solutions cannot bridge the two metals at points where they are in close proximity, or of excluding from the joints all moisture which might constitute a conducting solution.

The West Coast offers an excellent opportunity to test the ability of metals to withstand galvanic corrosion under natural, rather than synthetic conditions. Prevailing westerly winds pick up salt spray on the beaches and carry it inland, depositing a great part of it on areas west of the first reasonably high range of hills. Fumes from oil refineries, smelters, steel mills, chemical plants, fertilizer plants, etc, in the vicinity of San Francisco Bay, are as prevalent as in any industrial area. In the central valley area there are fairly large alkali deposits and large sections where acid dust from peat soil presents a problem. As a result, troubles with aluminum connectors have shown up on test racks and in field installations in a relatively short time.

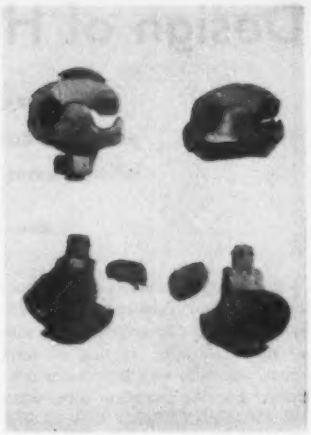
The tests reported in this article were initiated to investigate the problems of aluminum-to-copper connector performance and life under the adverse conditions prevailing along the Pacific Coast. Results of the tests were expected to indicate the best equipment available, and to serve as a guide and positive basis for limiting the substitution of aluminum for copper where such substitution would be unwise from an engineering standpoint.

The coincidental discovery that aluminum-to-copper connections were deteriorating at a serious rate 100 miles inland from the coast, where salt spray had never been observed, only served to emphasize the seriousness of the problem. Pending completion of the tests, further application of aluminum on PG & E distribution circuits will be limited to covered all-aluminum conductor in sizes from 6 to 1/0, away from coastal and heavy industrial areas.

Careful Inspection Needed . . . Our own experience indicates that serious deterioration can take place without any casual indication of trouble or failure in the field. Only careful inspection will reveal the prevalence of such incipient failures, since men in the field will generally put up with minor repair work as normal maintenance, filing only normal reports.



CONSIDERABLE CORROSION resulted on copper split bolt connectors with bimetal washers. Three on left were heavily taped, but taping was not extended over weatherproofing, and moisture entered through interstices in the conductor. Upper right was taped, No-Oxid on exposed conductor prevented moisture, no corrosion is apparent. Other two were not taped, No-Oxid in the middle, Penetrox on the lower failed to stop corrosion

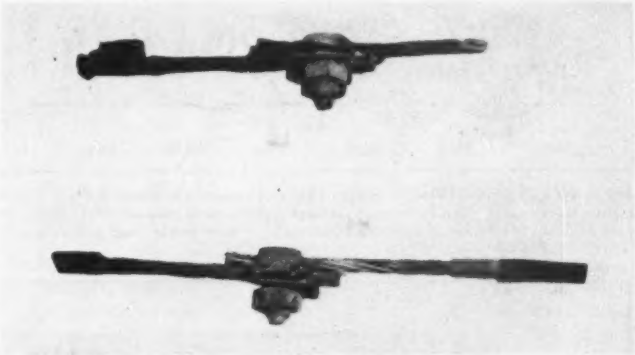


PARALLEL GROOVE CLAMPS with soldered copper liners split apart completely. Top right has copper liner pried away from body of aluminum casting after four months, apparently by growth and decomposition of the solder. Apparent growth of solder progressed to point where pieces of the body castings split off after nine months (*lower*). Deterioration was similar, but greatly retarded when connector was grease protected.

Coast tests

We believe that troubles that have developed here are peculiar to our climate and geography only in that they occur in such a short time. We feel that similar troubles will develop in many places in the country long before the conductor itself has lived its useful life. No urban or industrial area in the country is free of fumes or other contamination which can form a conducting electrolyte and eventually cause trouble with exposed aluminum-to-copper connections. No one builds lines for as little as ten or fifteen years of trouble-free operation and widespread trouble with connectors cannot be tolerated within the life span of the conductor itself.

It is neither sound engineering nor economically feasible to design lines for the presently accepted normal life expectancy, unless there is reasonable assurance that all the components are good for that full life. If the electrical utilities are to extend the use of aluminum as standard conductor to urban and industrial construction on a sound long-range basis, the long standing problem of unsatisfactory life of aluminum-to-copper connectors must be solved.



BIMETAL WASHERS were in bad condition on these aluminum alloy split bolt connectors after nine months exposure. In upper sample, treated with No-Oxid, aluminum was being eaten away on one side, copper side split from aluminum on other side of same washer. Nut on lower untreated one, split in several pieces after six months. Cadmium or tin plating on copper split bolt connector, No-Oxid treated, was also apparently ineffective

HEAVY DEPOSIT of aluminum salts at right end of this copper split bolt connector, with two bimetal washers, indicates that moisture entered through interstices in the stranded conductor. Airseal cover prevented other entrance of moisture. Condition good after 9 months

Design of Hillside Spans Simplified

Short-cut method proposed is accurate for practical purposes and has given satisfactory results in practice. Series of hillside spans increases problem. Short-cut methods illustrated

JOHN M. HUSTON, Consulting Engineer, Chattanooga, Tenn.

With proper formulas and methods the design and construction of "hillside spans" can be accomplished with as much accuracy as that of level spans, and with very little more difficulty. For the purposes here, when the elevation difference between supports in one or a series of spans is enough to cause errors in design or difficulties in construction, they are treated as "hillside spans."

The greatest and most apparent trouble with hillside spans is caused when wire is strung in blocks through a series of spans at different elevations. The tension increases in direct proportion to the increase in elevation, and since the tension on both sides of the blocks is the same, the tension will increase throughout the series of spans in the same proportion. Another result is that the horizontal tensions in adjacent spans will be unequal, so that the difference in horizontal tensions will act as a force tending to overturn the structure.

For consideration here, a ruling span of 1,000 ft is assumed with a conductor weight of 1 lb per ft so that the tensions are the same as the ordinates of the catenary.

Elements of the ruling span are:

Span	1,000 ft
Weight per ft	1 lb
Horizontal tension	3,125.0 lb
Maximum tension at the supports	3,165.1 lb
Sag at the center of the span	40.1 ft

In Fig 1, Span 1-2 is the ruling span, having the correct sag and tensions. Spans 2-6 have a difference in elevation of their supports of 100 ft each. The wire is held at 1, runs through blocks from 2 to 6, and is pulled beyond 6. The tension varies as the difference in elevation so that it increases 400 lb between 2 and 6. None of these spans taken as an isolated case is a problem in hillside spans. But in Span 5-6 the tension is 334.4 lb too high and its sag 4.7 ft too small. If Span 1-2 is maintained at the correct sag and tensions, Spans 2-6 cannot be given the correct sags and tensions so long as the wire is in the blocks.

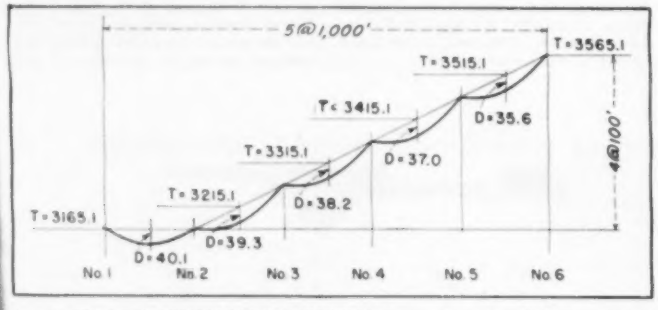


FIG 1—EFFECTS OF DIFFERENCES IN ELEVATION of supports are increased where there is a series of such spans. Span 1-2 is ruling span and supports are at same elevation. Spans 2-6 have difference in elevation of supports of 100 ft each. Wire is held at 1 and pulled beyond 6

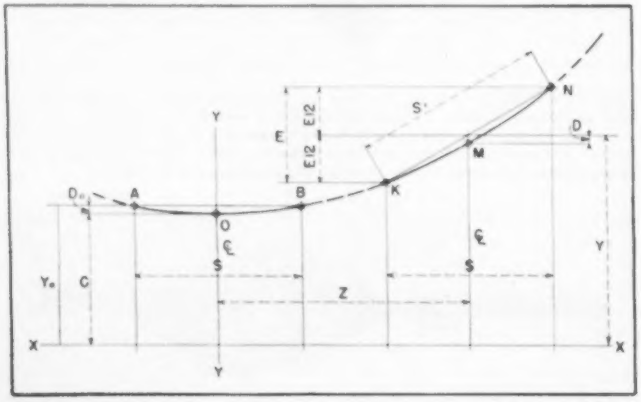


FIG 2—ELEMENTS OF HILLSIDE SPAN can be described as corresponding elements of level span, multiplied by suitable factors. AOB is level span. KMN is span which is section of same catenary and thus has same horizontal tension. Horizontal tension is H, wire weight is W

The solution is to clamp the wire to the insulator strings so that they hang plumb, thus equalizing the horizontal tensions. Construction forces, although competent, have considerable trouble in solving this problem.

Solve Single Spans . . . The elements of a hillside span can be described as the corresponding elements of a level span, multiplied by functions of the length of wire in the level span and the difference in elevation between the supports.

In Fig 2, AOB is a level span of wire which is a section of a catenary. Its horizontal tension is H and the weight of the wire is w. H/w equals

C which is the ordinate of the catenary at the low point O, on the YY axis, and determines its curvature.

The elements of this level span are:

S = Length of span.
T_0 = Tension at A and B.
$Y_0 = T_0/w$ = Ordinates at A and B.
D_0 = Sag at center of span O.
L_0 = Length of wire in span = AOB.
$Y_0 = C \cosh S/2C$
$D_0 = C(\cosh S/2C - 1)$
$L_0 = 2C \sinh S/2C$

In Fig 2 KMN is a span which is a section of the same catenary and thus has the same horizontal tension.

Elements of this hillside span are:

S = Length of horizontal span.
E = Difference in elevation between the supports.
Z = Horizontal distance of the center of the span from the YY axis.
T = Average of tensions at the supports.
Y = T/w Average of the ordinates at the supports K and N, or the average of the tensions at the supports divided by the weight of the wire.
D = Vertical sag of the wire at the center of the span M below the chord between K and N.
L = Length of wire in the span = KMN.
L_1 = Length of wire between O and N.
L_2 = Length of wire between O and K.
T_A = Average of the tensions in the wire.
LF = Length factor.
SF = Stress factor.

$\sinh Z/C = E/L_0$

$\cosh Z/C = \sqrt{1 + E^2/L_0^2}$

$Y = T/w = Y_0\sqrt{1 + E^2/L_0^2}$

$D = D_0\sqrt{1 + E^2/L_0^2}$

$L = L_0\sqrt{1 + E^2/L_0^2} = \sqrt{L_0^2 + E^2}$
$L_1 = L/2 + EY_0/L_0$
$L_2 = L/2 - EY_0/L_0$
$T_A = T - (T_0L_0 - H)/2L$

Since S is only slightly smaller than L_0 it can be substituted in the formulas without the loss of practical accuracy. When tables or charts using factors are used the slope span can be used.

TABLE 1—Data for chart used in solving a series of spans

$$dLw/dT \quad \frac{4(LSw/T - Sw/H)}{4 - L(Sw/T)(Sw/H)}$$

Sw/H	Sw/T	dLw/dT
.050	.04998	.000013
.090	.08991	.000061
.100	.09988	.000083
.150	.14958	.000282
.200	.19900	.000671
.250	.24806	.001314
.300	.29666	.002280
.325	.32076	.002907
.350	.34471	.003640
.375	.36850	.004490
.400	.39213	.005465
.425	.41558	.006576
.450	.43884	.007833
.475	.46191	.009246
.500	.48477	.010826
.550	.52984	.014530
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.650	.61712	.024454
.660	.62562	.025655
.680	.64250	.028183

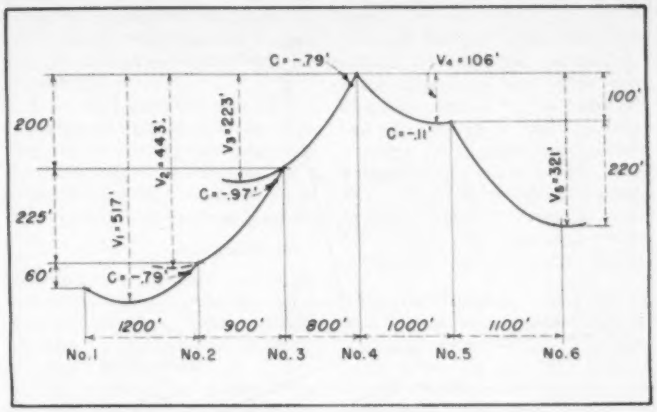


FIG 3—GENERAL PRACTICE is to string from level section through series of hillside spans to point where line levels out again. Solution of problem present is found in table below

TABLE 2—Solution of Hillside Span Problem Above

Structure No.	Span ft	E ft	V ft	k dLw/dT	kxV	dV Vx−V	dL dV×k ft	C
1								
2	1200	60	517	−0.00470	2.42990	−166	+0.78	−0.79
3	900	225	443	−0.00200	0.88600	− 92	+0.18	−0.97
4	800	200	223	−0.00140	0.31220	+128	−0.18	−0.79
5	1000	100	106	−0.00276	0.29256	+245	−0.68	−0.11
6	1100	220	321	−0.00370	1.18770	+ 30	−0.11	
				.01456	/5.0836			

V_x = 351 ft

S' = Slope span = $\sqrt{S^2 + E^2}$
$T = (T_0/Sw)S'$
$D = (SF)S'$
$L = LF)S'$

Exact solutions can be made with very little more difficulty.

If the horizontal tension is known, L_0 can be determined directly and the exact formulas used.

When the average of the tensions at the supports is known, an approximate value of L_0 can be determined, using Martin's Tables, by taking $Sw/T_0 = S'w/T$. From the tables the length factor is interpolated and $L_0 = (LF)S$. Using this value the solution is repeated, if necessary several times, until the value of Sw/T_0 or LF does not change, which indicates that the solution is exact to the limits of the tables. In most cases one repetition will give the exact solution.

When the sag at the center of the span is known, the same method can be used.

A solution of a hillside span for changes in loading and temperature can be made by the same methods used for level spans. A curve, similar to the Thomas Curve, can be drawn for any set of spans having the same ratio of E/S; also the stress-length factor curves used in the ACSR Method can be drawn.

For practical solutions the curves or charts used for level spans can be used by substituting S' for S; thus T/S'w, S'w/A, S'w/AE.

Series of Spans . . . For a series of spans the problem is to erect the wire on suspension insulators at a given horizontal tension. This is done by plumbing the insulators so that if the correct length of wire is in the spans, the sags and tensions will be correct.

This is done in the field in three steps, illustrated by Fig 3.

1. A length of wire is sagged in between Structures 1 and 6 and held fixed at these points by snubs. Struc-

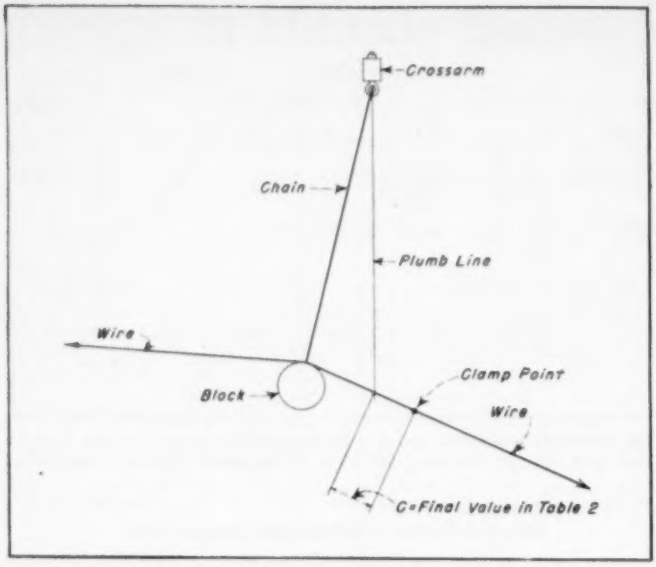


FIG 4—CLAMPING DIMENSION, C, is measured along the wire and when all insulators are clamped the clamping point will have moved to the plumb line

tures 1 and 6 do not need to be dead ends unless the design tension or ruling span changes at these points. The length of wire is determined by measuring the sag in one or more spans. These sags are not the same as those after clamping but are based on the tensions in the wire while in the blocks.

2. Clamping points are marked on the wire by measuring a given distance from a line plumbed from the point at which the insulator is attached to the structure.

The clamping point distances are final values, C, in Table 2 and are shown in Fig 3. All C's in example 3 are negative and are measured back or to the left. If they are positive, they are measured ahead or to the right, Fig 4.

3. When all of the clamping points are marked, the insulators are clamped at these points. When all of the insulators are clamped, they will hang plumb. If the adjoining spans are at the same horizontal tension, the insulator can be clamped at Structures 1 and 6 and the snubs taken off without disturbing the sags and tensions in the spans.

The length of wire strung between Structures 1 and 6 is the total length required in these spans when it is in the clamps. When it is in the blocks, the wire is not distributed correctly; but by clamping the insulators at the given points it is redistributed so that each span has the correct length.

This problem can be solved by an Exact Method, which can be carried out to any degree of mathematical accuracy required, or by a Short Method, which is derived from the exact method.

Exact Method . . . In both solutions tension will be used to mean unit tension. Unit tension is the real tension divided by the weight of the wire per foot. The unit tension is the ordinate of the catenary at the given point so that differences in elevation are the same as differences in unit tension.

A unit horizontal tension is established, usually the same as in the ruling span, which is also the ordinate at the low point of the curve. This is the horizontal tension of the wire when in the clamps.

Using this horizontal tension, the average tension, length, and the sags, if wanted, are calculated for each of the spans.

Tensions calculated are the average of the tensions at the supports which are also the average of the ordinates at the supports. To these tensions are added the differences in elevation to some common point, such as the highest structure, to get the "loaded tensions." The loaded tensions would be the tensions or ordinates of the wire if the curves were extended through the supports to the elevation of the common point. They will be different unless two spans happen to have the low points of their curves at the same elevation.

Loaded tensions will be called T_1, T_2, T_3, etc.

When the wire is in the blocks, the tensions will vary throughout the spans as the difference in elevation so that the loaded tensions in all of the spans will be the same.

The loaded tension in the blocks will be called T_x.

The rate of change of the length of wire to the rate of change of the tension is the derivative dLw/dT, see Table 1, which varies approximately as the span length raised to the third power.

The rates of change will be called k_1, k_2, k_3, etc.

When the wire is taken from the blocks and put into the clamps, the change in tension will be

$$(T_x - T)$$

And the change in length will be approximately

$$(T_x - T)k$$

A condition of the solution is that the total length of the wire in the spans does not change;

$$(T_x - T_1)k_1 + (T_x - T_2)k_2 + (T_x - T_3)k_3 \ldots = 0$$

$$T_x = \frac{T_1k_1 + T_2k_2 + T_3k_3 \ldots\ldots}{k_1 + k_2 + k_3 \ldots\ldots}$$

When T_x is found, the differences in elevation are subtracted to get the average tension for each span; and the lengths are recalculated and added together. The total length should agree with the first calculation within practical limits. It can be corrected by dividing the difference by the sum of the k values and adding the result to the tension and recalculating the lengths.

The change in span lengths and differences in elevation due to the swing of the blocks can be corrected by assuming that the block will swing at an angle which is the bisector of the angles at which the wire pulls out of the clamp.

The change of length due to the change of tension can be corrected by adding Lw/AE to the k values. This change must be added to the lengths to make the total lengths agree.

Short Method . . . To solve this problem by the short method the unit horizontal tension is established as before. A template whose curve conforms to this tension is used on the profile to locate the low point of the curve of the wire in each span. If the difference in elevation to the common point, as in the exact method, is added to the horizontal tension, it will give the loaded tension. This does not need to be done at this point because the changes in tension are the only values used in this step.

These differences in elevation will be called V_1, V_2, V_3, etc.

A value of V_s is found, which corresponds to T_s.

$$V_s = \frac{V_1k_1 + V_2k_2 + V_3k_3 \ldots\ldots}{k_1 + k_2 + k_3 \ldots\ldots}$$

The change in tension will be

$$(V_s - V)$$

The change in length will be

$$(V_s - V)k$$

For convenience the operations should be carried out algebraically. The k values are negative. Thus if V_s is smaller than V, $(V_s - V)$ will be negative and $(V_s - V)k$ will be positive, that is an increase in length.

The clamping points are found by adding, algebraically, the changes in length beginning at the last span and going back. The clamping point distance at any structure is the sum of the changes of length in the spans ahead of it.

Stringing sags are calculated by adding the horizontal tension to V_s and subtracting the difference in elevation to get the average of the tensions at the supports. Note that these tensions are unit tensions and equal T/w in the sag calculations.

It is not necessary to calculate sags for all spans since they are based on the wire distributing itself according to the differences in elevation. It is desirable to calculate them for two or three spans for the purpose of checking.

Example . . . The spans 1–6, shown in Fig 3, are to be erected with a horizontal tension of 3,125 lb in each. A condition of this is that the insulators hang plumb.

The problem is to determine the stringing sags, which will give the correct total length of wire in the spans, and the clamping points, which will distribute the wire so that the insulators will hang plumb. The solution of the problem in Fig 3 is shown in Table 2.

Change in length in Span 1–2 should be equal but opposite in sign to the clamping dimension at structure 2. There is an error of .01 which is due to rounding off the third decimal.

Proved In Practice . . . The case shown in Fig 3 is a moderate example of this calculation, although the configuration is typical. The practice has been to begin a section at the end of level ground on one side of a ridge and end it at the beginning of level ground on the other side. Up to 18 spans and a maximum difference in elevation of 900 ft have been included in one section.

On the first line on which the short method was used the sections for which calculations were made were especially checked by the inspector. Out of a total of 42 structures there was only one on which the insulators were noticeably out of plumb. This was only a small amount and was well within the limits of acceptable work. The sags, after clamping, were checked and found to be as calculated.

Theory of Design . . . If a hillside span has the same rate of change of horizontal tension to change in temperature or loading as a level span, it can be considered as equivalent in determining a ruling span. It can be arrived at, by a reasonable approximation, that a hillside span has the same ratio to the slope span as an equivalent level span has to the hillside span.

S' = Slope span.
S = Hillside span.
S_1 = Equivalent level span.
$S_1 = S^2/S'$

If this is applied to the spans in Fig 3;

Hillside Span	Equivalent Level Span
1200 ft	1200 ft
900 ft	805 ft
800 ft	715 ft
1000 ft	995 ft
1100 ft	1080 ft

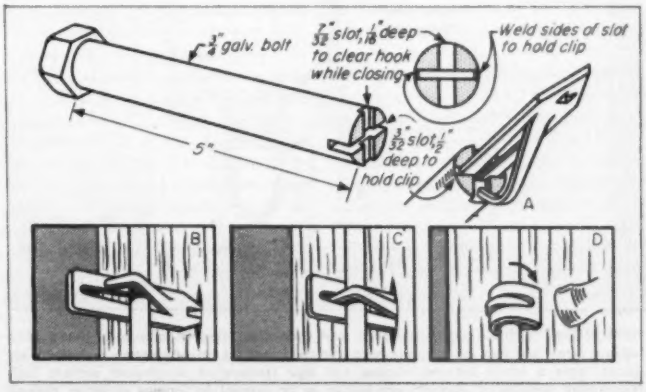
These differences could be considered in choosing a ruling span; but since the spans in rough country tend to be longer, the answer is likely to be the same.

Tool Reduces Spoilage of Ground-Wire Clips

T. E. EDWARDS, Line Foreman
DWIGHT L. HARTMAN, Maintenance Man, The Ohio Power Co, Lima

A simple driving tool, illustrated, has been devised that avoids spoilage of ground-wire clips. During its test, in which 100 grounding clips were driven into different types of poles—cedar, pine etc—no bending of clips was experienced. Previously about 20% of the clips were bent and ruined while being driven with a hammer.

The driving tool has made unnecessary the purchase of heavier clips which cost 1 or 2 cents more than our present clip. Considering the thousands of clips used, this tool has resulted in a worthwhile saving.

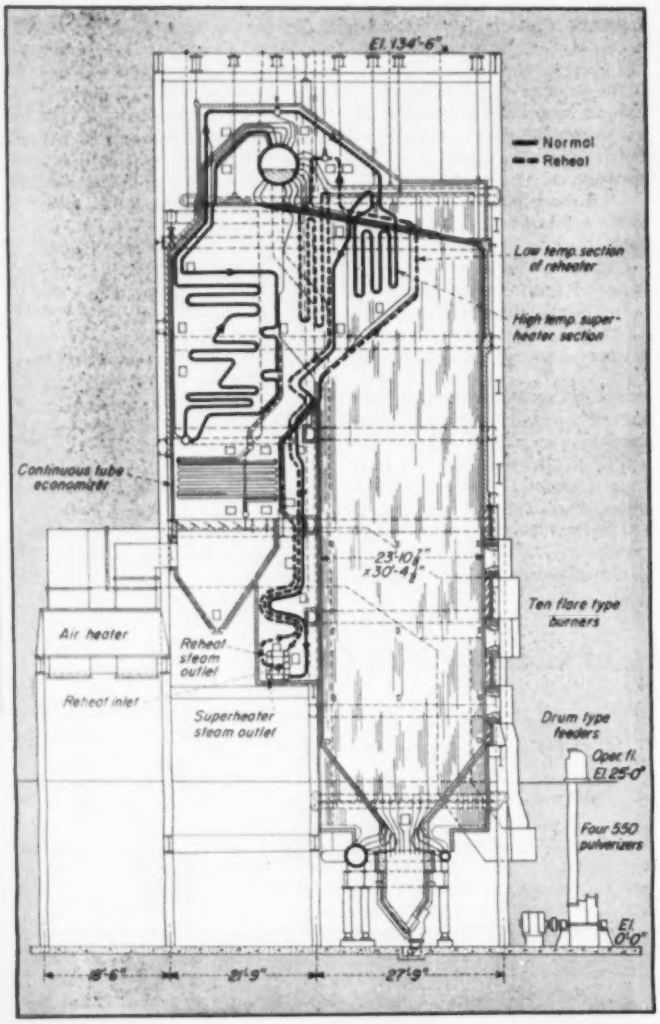


TOOL holds clip (A) for driving into pole (B). Hammer is used (C, D) to complete the job

New Reheat Design in Gadsby Plant

More uniform total superheat with changing load and operation with exit gas temperatures low enough to prevent slagging is purpose of combined radiant and convection reheater surfaces

E. M. NAUGHTON, Asst General Mgr,
Utah Power & Light Co, Salt Lake City



NEW REHEAT DESIGN combines radiant and convection reheater surface to give a more uniform total superheat temperature with changing load. Low temperature section of reheater forms a screen between furnace and high temperature superheater section; high temperature superheater elements are spaced to be exposed to furnace radiation through reheater screen openings. Greater economy resulted from small increased cost

Reheat and increased pressure and temperature will make a difference of 3% in gross overall efficiency and 750 Btu per kwhr in net heat rate between the first and second units in Utah Power & Light's Gadsby station in Salt Lake City. This greater economy, which is very important in a plant with an anticipated annual load factor of 80%, plus the added benefit of greater capability, resulted from a relatively modest increased capital expenditure.

For a premium of only $817,000 more than a second standard 60/66,000-kw unit would have cost to install, the reheat unit will have a gross overall efficiency of 35% (compared to 32% for the first unit) and net heat rate of 10,450 Btu per kwhr (compared to 11,200). In addition, the 60,000-kw handbook machine designed for reheat has a capability of 75,000 kw at unity power factor compared to 66,000 kw for the preferred standard unit—a bonus of 9,000 kw.

Design of the reheat unit selected is conventional, with throttle conditions 1,450 psi, 1,000 F and 1,000 F reheat. Steam leaves the high pressure section at 467 psig, 730 F to be reheated to the 1,000 deg reheat temperature. For a given generator load, the lower quantity of steam required with reheat permits use of a smaller boiler, feed pumps, condenser, cooling tower, etc. On the other hand the higher pressure and temperature require heavier boiler drums, boiler, water wall, and economizer tubes, as well as more costly alloys for superheater, reheater, and main steam piping.

Other interesting features of the plant are provisions for transporting, storing, and burning petroleum pitch in the first unit (and when available in the second unit), factors affecting location, semi-enclosed design, and the new design of the second (reheat) boiler, first of its kind ever built.

Petroleum Pitch from a refinery 4½ miles distant is primary fuel for the

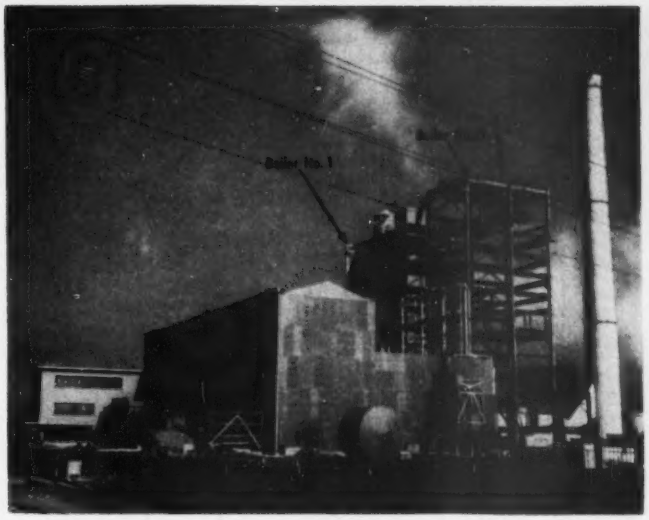
first unit and will be burned in the second unit as available. When the first unit was being designed, the refinery contracted to deliver a firm supply of pitch for its full operation, and the unit was built without any coal-handling equipment, although space was provided. Since additional pitch is not available for the requirements of the second unit, coal will be its primary fuel and full coal-handling equipment has been provided, including a 100,000-ton storage yard. Steam atomizing pitch guns are being installed on the second boiler as well as the first, however, and pitch will be burned as and when it becomes available.

Price of the pitch, while geared to the price of coal, is less (on an equivalent heat basis) than the price of coal after provision for fixed charges and amortization, during the life of the contract, of special equipment required for burning it. Pitch is strictly a by-product fuel, and the circumstance of availability was the chief factor influencing its selection as fuel for the first unit.

The pitch is residue from manufacture of gasoline and diesel fuel and has a heat content of 18,700 Btu per lb, with a maximum of 11.6% hydrogen. Impurities are a maximum of 2% sulphur, 0.35% ash, and 0.30% sediment by extraction. Viscosity is 5,000 SSU (Saybolt-seconds Universal) at 210 F, 150 SSU at 350 F.

High viscosity of the pitch at normal atmospheric temperature requires that it be heated for transport by pipeline. The refinery built and operates a heated pipeline 4½ miles long, with expansion loops every 700 ft. The pitch is kept at about 225 F during transport. The pipeline is made up of a 5-in. diameter pitch transport pipe and a 4-in. diameter steam heating line, enclosed in a 14-in. hermetically sealed steel shell lined with 2 in. of insulation. Steam to heat one half of the line is furnished by the refinery, the other half—about 3,400 lb per hour—by the generating plant.

The refinery has two 40,000-bbl insulated tanks for pitch storage, and UP&L has three 20,000-bbl insulated tanks at the generating plant. One of these is used for storing regular fuel oil for emergency use. External heaters maintain stored pitch in the 20,000-bbl tanks at 225 F, requiring connecting piping and pumps to the heaters as well as to the boiler burners. Approximately 500 lb of steam per hour maintains the three tanks at 225 F with an atmospheric temperature of 60 F. Preheaters near the boiler raise pitch temperature to about 350 F, and it is burned by steam atomizing pitch guns in the center of pulverized fuel burners installed in both boilers.



SEMI-OUTDOOR CONSTRUCTION was used in Utah Power and Light's Gadsby plant after cost analysis showed it less expensive to provide housing than to protect units against weather for full outdoor operation. Boilers are outdoor except for firing area

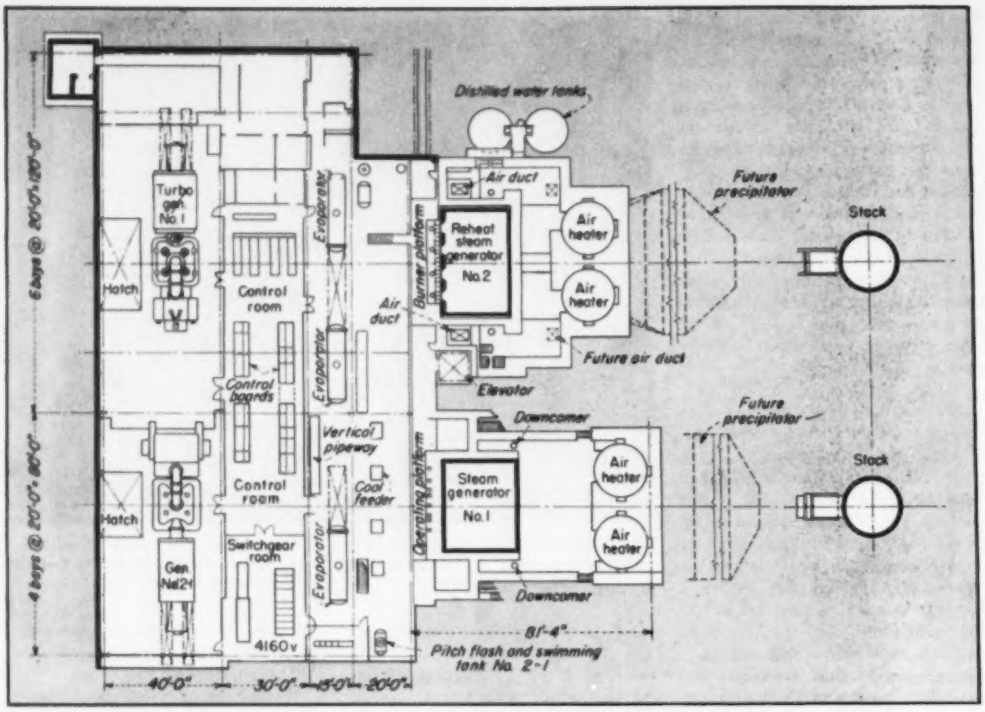
Eight Possible Locations were studied for proximity to load, cost of fuel, and availability of condensing water. They ranged from Utah coal fields 106 miles south of Salt Lake City to the north end of Bear Lake 150 miles northeast of the city but within 70 miles of Wyoming coal fields. Costs to deliver power into the Salt Lake region were closely comparable for all the locations. Even with cheaper fuel at the Bear Lake site, energy losses and fixed charges on transmission lines with transformation up to 220 kv and back down to 44 kv added up to more than the cost of bringing fuel to Salt Lake City, cooling tower operation, and city taxes. Initial investment was also less by the $2-3 million cost of the 150-mile transmission line.

Selection of the Salt Lake City site resulted in a problem of adequate foundations for the plant with its ultimate of three large units after borings to 1,000 ft showed the site to be on a series of ancient lake bottoms. For adequate support steel piling on 5½-ft centers was driven down to a lens 120 ft below the surface, filled with reinforced concrete, and covered with a 30-in. reinforced concrete mat.

Original design of the plant eliminated any housing above the turbine-generator operating floor. Plan was to provide sleeves in the floor for pipe frameworks to support temporary shelter for emergency or maintenance use in inclement weather. Cost analysis showed it to be less expensive to provide housing, however, than to have the units modified by the manufacturer against weather for full outdoor operation. Therefore, generally speaking, all plant equipment other than the boilers is housed. Boilers are completely outdoors with firing areas of their fronts abutting the building to protect operators from the weather.

New Boiler Design for the reheat unit uses a combination of radiant and convection reheater surface to permit operation with furnace exit gas temperatures low enough to prevent slagging troubles. In this new-type steam generator, developed by Riley Stoker Corp, temperatures of gases leaving the furnace could not be higher than 1,950 F, fusion temperature of ash from Utah and western Wyoming coal, basic fuel for the unit.

To apply the required amount of heat to the superheater and reheater surfaces for the specified final steam temperatures without exceeding this



MECHANICAL AND ELECTRICAL CONTROLS are combined on control boards in the centralized control room. Double doors opening into firing aisles and turbine room provide relative quiet. Major auxiliaries are on the ground floor, 25 ft below control room level

exit gas temperature requires that surfaces of both be disposed so that a portion of each can "see" the furnace. To accomplish this the low temperature section of the reheater forms a screen between furnace and high temperature superheater section, and the high temperature superheater elements are spaced so that they are exposed to furnace radiation through the openings of this reheater tube furnace screen.

Superheater steam temperature in a coal and oil-fired boiler normally rises with rising load in a purely convection superheater and drops with rising load in a purely radiant superheater. By disposing the surfaces of superheater and reheater so they become in effect a combination of radiant and convection surface the resulting steam temperature characteristic results in a more uniform total superheat temperature than for either a purely convection or purely radiant design.

Exposing the low temperature section of the reheater directly to the radiant heat of the furnace so it forms a screen between furnace and superheater pass is not only practical, but at least as safe as if the screen were water tubes subjected to natural circulation. If the screen were of water tubes it would be subjected to full operating pressure of 1,700 psig at saturation temperature that will be about 615 F.

Water tubes would be low carbon steel of heavy wall thickness to withstand the pressure, and the steam-water mixture would flow through the tubes by natural circulation at about 10 fps. Outer skin metal temperature of these tubes exposed to radiant heat and furnace exit gas temperature of approximately 1,950 F would be expected to be no less than 100 F above the steam-water temperature, or 715 F.

With the reheater tubes for the screen between furnace and superheater pass are steam cooled. Steam entering the reheater is a maximum of 720 F and approximately 450 psig, so the tubes are designed for 600 psig and are therefore of thinner wall thickness than the water tubes. Forced flow of steam through the furnace screen tubes at about 142 fps amounts to about 300,000 pounds per sq ft per hr, compared to approximately 36,000 pounds per sq ft per hr for the steam-water mixture flowing through the water-cooled steaming tubes. Steam temperature rise within the radiant portion of the reheater which forms the furnace screen is a maximum of 140 F so the maximum mean temperature of the fluid in the reheat screen tubes is about 790 F (720 + 70).

High rate of mass flow of steam passing through the tubes insures effective cooling. Coupled with the thinner walls this insures that the outer skin metal temperature of the radiant reheat tubes is not more than approximately 50 F above the fluid temperature, or a mean of 840 F maximum. This is only 125 F higher than the expected skin metal temperature of water tubes, but even so the reheat tubes are constructed of chrome molybdenum steel. The above values correspond to highest rate of steam generation, reheat flow, and

temperature of reheat steam entering the reheater, so represent the most severe operating conditions. Actual conditions during normal operation are expected to be much less severe, however.

Final reheat temperature of 1,000 F is maintained constant between 70% and 100% of reheat flow. Feed water spray controls the temperature, a spray nozzle being installed in a stainless steel lined header located between high pressure turbine exhaust and reheater inlet. Reheat steam exhausted from the high pressure section of the turbine contains superheat for any rate of steam flow within the control range.

Injection of feedwater spray into reheat steam entering the reheater will thus reduce the temperature of the reheat steam considerably below the 660 F mentioned. Actual normal operating temperature within the reheater tube screen and the resultant outside skin metal temperature of these tubes are some 30 to 100 F lower.

Starting Procedure . . . Even though the reheater screen is not cooled until steam flow is established, time required for starting is no more than for a large high pressure boiler with a standard superheater for 900, 950, or 1,000 F final steam temperature. Design of the furnace for comparatively low exit temperatures during normal and maximum steam output rates makes it possible to raise pressure in the boiler unit at approximately the same rate as for a more conventional boiler. The boiler is expected to start from cold in approximately six hours of continuous firing and establish full pressure operating conditions within six and one half hours. This length of time is after the lighting of one or two of the bottom burners.

In building up pressure from a cold start only one or two of the lowest burners are used. Firing is continuous, the rate being governed by the temperature existing in the upper part of the furnace immediately below the furnace screen. This temperature is maintained at or below 1,000 F, metal for the reheater screen being able to withstand 1,000 F without internal cooling.

In sufficient time before the full operating pressure of 1,500 psig is reached, possibly as low as 100 psig, the turbine will start to roll, a steam flow will be established through the high temperature superheater, high pressure section of the turbine, reheater, low temperature section of the turbine and into the condenser.

Emergency Measures . . . In the event that the turbine suddenly should trip out, interrupting steam flow, the automatic interlock will immediately stop pulverizer feeders which instantaneously extinguishes the coal flame, or it will shut off the flow of fuel oil. Popping pressure of safety valves at the outlet of the reheater is slightly above the maximum reheat steam pressure planned for normal operation.

Construction of the furnace envelope with entirely bare tubes on tangent spacing and with walls that are vertical, smooth, and free of protrusions, ledges, and arches keeps the walls clean of ash so there is little heat storage in the furnace and the furnace temperature will immediately drop to near saturation temperature following burner cut-out. Therefore no provision is made for protecting reheater and superheater against residual radiant heat within the furnace following a planned or accidental shutdown of the burners.

VITAL STATISTICS

—Gadsby Plant, Utah Power and Light Co., Salt Lake City

Ultimate capability 216,00 kw, three single boiler units
Present installation 1—60/66,000-kw preferred standard unit
1—60/75,000-kw reheat unit (Oct. '52)
Boilers outdoor, firing aisle protected, remainder of plant enclosed
Electrical, mechanical controls centralized in one control room
Combustion control fully automatic

No. 1	No. 2
Overall efficiency 32% gross Net heat rate—11,200 Btu/kwhr	Overall efficiency 35% gross Net heat rate 10,450 Btu/kwhr
Boilers	
620,000 lb per hr, drum pressure 1,500 psi	575,000 lb per hr, drum pressure 1,700 psi
Superheater outlet 955 F	Superheater outlet 1,005 F Reheater 420 psi, 1,005 F, gas exit 1,950 F
Boiler efficiency 88%	88%
Ten fuel burners on front wall, three rows	Ten fuel burners on front wall, four rows
Two forced draft, one induced draft fans	Two forced draft, one induced draft fans
Basic fuel petroleum pitch (future coal)	Basic fuel bituminous or subbituminous coal, petroleum pitch as available
Turbine-generators	
60/66,000-kw, preferred standard (hydrogen cooled)	60/75,000-kw, reheat (hydrogen cooled)
3,600 rpm, 1,250 psi, 950 F	3,600 rpm, 1,450 psi, 1,000–1,000 F reheat
Generator output 13.8 kv through isolated phase bus to two 37,500-kva 13.8/44-kv step-up transformers	Same
Auxiliaries	
Supply—one 7,500 kva, 13.8/4.16-kv transformer	Same
Voltage—350 hp and above 4.16 kv; all others, 440 v	Same
All electrically driven, including boiler feed pumps	Same
Condensers	
Single pass, 375,000 sq ft tube surface	Same
150 cfs cooling water from one cooling tower	Same
Makeup from Jordan river as available, or city water system	Same
Switchyard 44 kv, provision for ultimate of 12–25,000-kva circuits	

Vision in Power

More is needed than just engineering studies and statistical projections to produce a clear picture of the power system of the future. Bold imagination must be coupled with technical skill and enterprise

PHILIP SPORN, President, American Gas & Electric Co

★

"Make It Plain . . ."

"Write the vision, and make it plain upon the tables, that he may run that readeth it." So spoke Habakkuk. Although these are the words of an Old Testament prophet, they are good advice for today's electric utilities.

In this article, Philip Sporn tells why and how vision is needed to see wholly and clearly the power system of tomorrow. He does not mean vision circumscribed by immediate engineering and economic facts and statistics; he means vision of wider scope that takes in much larger and less tangible considerations such as social responsibility and human welfare.

Among the points covered by Mr Sporn is the need for instilling a vision of the future of the industry into the minds of young people to attract them to it. Here is where Habakkuk's words apply. They lay a charge upon all levels of electric utility management to see the vision of what electric power will mean in the world of tomorrow, to write it, speak it, show it, to "make it plain upon the tables," so that, knowing what the future holds, coming generations will run to the industry in high hope of service and reward.

★

The role of power in the life of a country like ours is out of all proportion to its economic value as measured by price. First produced commercially here some 70 years ago, electric power today has become indispensable to the daily living of most Americans—in the home, in community functions, on the farm, and particularly in industry. In the prodigious hive of industrial activity that is the strength and achievement of this nation, electric power is the energizing force without which most industrial and even home activity would be impossible.

Engaged as we now are in an effort of vast scope to build up our defenses and to strengthen the defenses of other free nations, it is necessary to utilize all our resources to produce armor powerful and plentiful enough to restrain potential aggressors or to defeat them if war comes. In bringing all this about, power will play a decisive role. It is even more vitally linked with peacetime progress and our ability to continue to grow and provide for the physical and spiritual welfare of an expanding population.

Let's Look Closer

The true place of power in our overall picture may be gauged better if these introductory statements are expanded.

1. That power and national welfare are synonymous is much too categorical a statement. Power is vitally important to industry; yet in most industry the cost of power represents a bare 7/10 of 1% of the cost of production. But power can be critically important—if it is absent.

2. The role of power is growing. Electric power is the one form of energy that man has been able to produce that is ideal from almost every standpoint in every sphere of man's activity, and this aspect is gaining recognition.

3. Utilization of power is subject to an unusual rate of growth. The use of electric energy is still increasing so fast that its growth pattern is not yet fully established. This characteristic of an undefined growth pattern can be matched only by very young industry.

4. The importance of power in national defense cannot be overemphasized. Electric power is one of the key factors in mobilizing our industrial resources. This is true of all defense industry. It is especially true of many special war industries like the atomic diffusion or separation plants at Oak Ridge, the similar plants being built at Paducah, and other nuclear operations in a less advanced stage.

5. Electric power has a part to play in assuring peace or in restoring peace if we have to undergo the ordeal of war. This is because the bringing about of peace is inevitably linked up with the problem of acceptance by the masses of the world of belief and faith in our system of freedom—both political and social-economic. But this is tied to the problem of improving and kindling hope for

further improvement of the lot of the average man all over the world. That improvement cannot come except by further improvement in our productivity as a prelude to helping less advanced peoples of the earth improve theirs. All this involves more electric power.

6. If we are to get maximum utilization of electric power we need the most economical development and the most economical operation. For only by insisting on such criteria will we bring about the result sought with a minimum call on the country's resources and manpower. Production of electric power is a most complex and a unique technical-economic operation. It requires large quantities of capital per unit of capacity and energy produced, transmitted and distributed. In addition, the economics of the enterprise demand a low rate of depreciation. These requirements call for a great deal of advance planning to avoid obsolescence due to inadequacy; that in turn means long reaches into the future. For unless the fog of the future is pierced by vision, neither size nor technical dimensions can be discerned.

Sound development of power systems is not possible unless boldness and imagination—vision—in projection and conception are liberally intermingled with technical soundness and economic responsibility.

Vision isn't introduced into power system development merely by making engineering studies and evaluations, or economic projections—although these activities help. The technical studies, as often as not, stop short just at the point where they need very much to advance. To paraphrase John Tyndall—we cannot stop abruptly where our slide rule value ceases to be of use. Here vision is needed; here special insight and intuition are required to supplement the purely technical judgment.

Vision obviously cannot be confined to things physical in a field such as electric power where perception is needed in the social, social-economic and even political spheres. Like a good many chemical reactions which cannot occur except in a solution of a certain pH, it seems to me that vision is impossible except against a background of understanding of the life of the community, recognition of the aspirations of the various segments of the population and finally an awareness of the bases of their economic well being.

Vision is often a swiftly transient glimpse of a whole, providing a mental picture that the wise man tries to hold. In an instant one may see clearly and boldly a full development, a system, or the consequences of a policy. And in that instant one may get a clear basis for judging intrinsic worth, economic soundness, or basic wisdom of each of these respectively. An almost infinite amount of work may be necessary to fill in various aspects of the picture before it can meet, in the light of cold judgment, the test of reason and analysis. It may even be necessary to invent new tools, devices, and organizations not previously tried or known. But unless the end vision is clearly kept in mind these will never come into being, and the end so desirable and desired will never be brought about.

The Statistical Development

It should be possible to relate these general observations to concrete experience in some measure. Consider, for example, some recent projections into the future made by the American Gas & Electric Co System. Here are the peak demands of this system over a quarter of a century:

Year	Maximum One Hour Peak Demand
1930	614,000 Kw
1939	909,000 Kw
1951	2,700,000 Kw
1954 (estimated)	3,600,000 Kw

Thus, between 1939 and 1954, demand will have quadrupled; this is equivalent to a compound growth of 9.6% per year. If this rate of growth should continue to 1970, the system demand at that time will be 15,600,000 kw. The average annual rate of growth over the period 1930-1950 was 7%. If this rate of growth is used to project to 1970, a demand of 9,300,000 kw is indicated. If the 7% rate of growth is used as a basis of projection from the reasonably certain 1954 demand base, then the demand to be looked forward to in 1970 is 10,700,000 kw. Thus it appears that, depending upon what rate of growth and what base year are chosen for the purpose of projection, the 1970 demand that may be expected will vary between 9,300,000 kw and 15,600,000 kw.

Similarly, the application of suitable load factors to the peak demand projection indicates a possible system input in 1970 of between 57.2 billion and 96.0 billion kwhr. System input for 1951 was 15.96 billion kwhr.

None of these relatively simple projections has been accepted as a serious indicator of what demand and system input are likely to be in 1970. But they have been catalytic in generating a view of a possible growth and development—of there coming into being a complete power system simply unimaginable only a few years ago. And they have served to bring into focus a host of problems that will be pressing for solution, some of which had not been encountered previously and others which, while they may have been met earlier, will appear in a form so much sharper and more critical as to constitute new problems. Two implications of the outlook are plain:

1. Demands of the order indicated will never come about unless they have been visualized, prepared and worked for.

2. The solution of practically all of the major problems incident to such enormous increase in demand will never be achieved or be worked out soundly unless they are visualized and developed in congruence with the vision of power.

The Concept of Electric Power

What is that main concept? I believe its outlines are quite clear. They show a social-economic institution that:

- Is closely interwined with the economic functioning, and is therefore dedicated to the requirements of its area.
- Is existing, growing, and expanding even to a future quadrupling of its present limits in a comparatively short term of years if that is indicated by statistical projection.
- Perceives in advance and is prepared to meet the electrical demands of all classes of consumers—urban-residential, rural, commercial, industrial, and governmental.
- Utilizes for that purpose new aids and instrumentalities, technical and economic, to carry out the functions of generation, transmission and distribution in the most reliable and most economical manner.
- Develops utilization of electrical energy to the utmost.

The objective of all this?—To promote the security and social-economic welfare of the community and its citizens, and as well of all the people cooperating in rendering the

service—the owners, managers, supervisors, and the thousands of members of its large family of employees.

The conception goes further. It includes in its scope service and worth. It definitely reaches toward a horizon of social usefulness and responsibility as the basis for maximum assurance of continuing to function. This, in effect, merely recognizes the danger of a vacuum created by failure to respond to opportunity or need. Of course, indispensable prerequisites to assurance of continuity of function are trust and confidence in the ability of the country, its institutions, and its people, to move forward.

Problems Fall into Place

With that outlook clearly before one, the many problems, some quite difficult, brought about by such growth and expansion as I have indicated, fall into their logical places. And all can be worked out in harmony. Planning, building, staffing, operating, and the problems associated with all of them take their cue from the main theme.

Consider, for example, the problem of generation and the question of generating plant sites. Who, in the light of the prospects I have indicated, can become careless with a good site or indifferent to the importance and value of developing prime sites sufficiently ahead of need to be sure of availability when actually needed? Who can project a program that involves underdevelopment or under-projection of a good site?

Or examine the basic question of fuel. With quantities of energy, of the order indicated, to be generated fuel, as the one indispensable and most important element in providing mass generation of electric energy, becomes something more than a commercial commodity to be obtained as needed by asking for bids from prospective suppliers. The importance of exploring a whole series of questions: Sources, reserves, technical and economic soundness of entrepreneurs, becomes apparent. And the question of the competitive position of various fuels: Coal, oil, gas, char, when and if it becomes a significant commercial commodity, and atomic fuel, when and double "if" it becomes a commercial item—all of these fall into their proper places in the time scale.

Again, consider the question of turbine and boiler sizes. I have been told of system planners or executive directors who within the past year or two had declared that they never would have need for units above a certain size—say 50,000 or 60,000 kw. I do not say that this particular rating could not have been the ideal rating for that particular system at a certain time. Nor would I deny that larger sized units bring with them additional technical and economic problems. But it must be obvious that only those who visualize inadequately can hobble themselves and the systems they project by categorical prejudgment as to what size they will or will not permit in the development of their systems.

Or take the questions of temperature, pressure and thermal cycle in the modern steam electric plant. All the heated arguments as to whether 900 psi 850 F constituted or did not constitute a natural limit to further progress in thermal and economic efficiency, and all the fear, uncertainty, and hesitation as to whether to reheat or not to reheat, show up in their true perspectives in the illumination furnished by a broad picture of the system and development ahead. How, in the light of expansion potentials such as I have indicated, can one rest on present limits of performance as long as science and technology are opening up new vistas?

For a period of years we have been having controversial discussions about the economics of this or that extra-high voltage—220, 287, 330, and even 400 kv. I have heard engineers of standing and accomplishment say that they could never see the usefulness of any higher voltage than 220 kv. And yet it is obvious this is no subject that can be even half rationally studied and analyzed until something more than present or relatively close-at-hand system projections are made and studied. Here in particular, the view of a system going well beyond anything that is called for in the present is a necessary prerequisite for technical development.

Of all the elements that have to be brought together in a soundly conceived and efficiently functioning electric power organization, none is as important as people—the people necessary to visualize, plan, build, direct and operate. People endowed with skill, people trained in many specialized fields, people of character—productive people. But, in a complex industry like ours, such people can only be found and are only available when needed if they are brought into the industry at the right time and later are properly trained and permitted to develop.

But if this need isn't projected and communicated to others—to those directing the affairs of our secondary schools, of our colleges and technical schools, to the faculties of those schools and to their students—how can one expect young people to become enthusiastic about allying themselves with our industry? How can one expect young people, if they are not shown a vision of great things ahead, to exert by their demands for training and instruction pressure strong enough to bring into being schools adequately equipped and manned by faculties of high competence and inspiring leadership?

It seems clear to me that the personnel problem—the problem of bringing in the right people and the problem of keeping them inspired, happy and productive—can only be solved with many years of effort as a part of the conception of the long term picture of the industry. Without this vision, the realization will be patched, partial, inadequate, ineffective and uncertain.

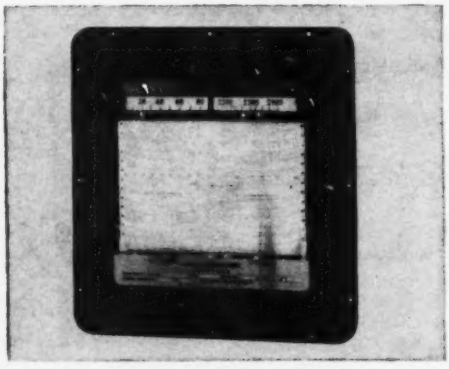
Bigger Industry, Bigger Problems

Our industry today is confronted by problems that, in size and scale, go far beyond anything that could have been reasonably projected only a relatively few years ago. For example, one large power group is today wrestling with a problem recently placed before it as a result of our expanding defense effort that in the power field, at any rate, has never before been even remotely approached from the standpoint of size, complexity, and multiplicity of ramifications. Solution of the problem does not lie in exploration of any of its many attractive by-paths. If the problem is not visualized in its whole and all its parts placed in the context of the whole, the solution as a whole will most certainly be exasperatingly difficult.

It seems to me that the same basic relationships apply to and govern all other fundamental problems of the power industry. If, on top of its achievements as a social-economic force operating in a complex technical field, the industry can maintain vision, all will be well. The day it loses vision will be a sad day for the industry and a sad day for the country as well.

AT PORT HURON, TYPE CD RECORDING AMMETERS GIVE QUALITY PAPER STOCK BY ASSURING UNIFORM PRESCRIBED LOAD FOR REFINERS

G-E Recorders Measure Many Quantities; Take Guesswork out of Process Regulation



CD-37 DUPLEX RECORDERS are available for recording simultaneously such quantity combinations as watts and vars, watts and frequency, and volts and amperes.

"Our General Electric CD recording ammeters take the guesswork out of regulating the load on each of our refiners. We could not operate without them," reports G. F. Durand, Vice-president of Port Huron Sulphite and Paper Co.

RECORDING INSTRUMENT applications are as broad as the field of electrical measurement. For that reason General Electric provides a complete line of ink and inkless Type CD recorders, in both portable and switchboard lines.

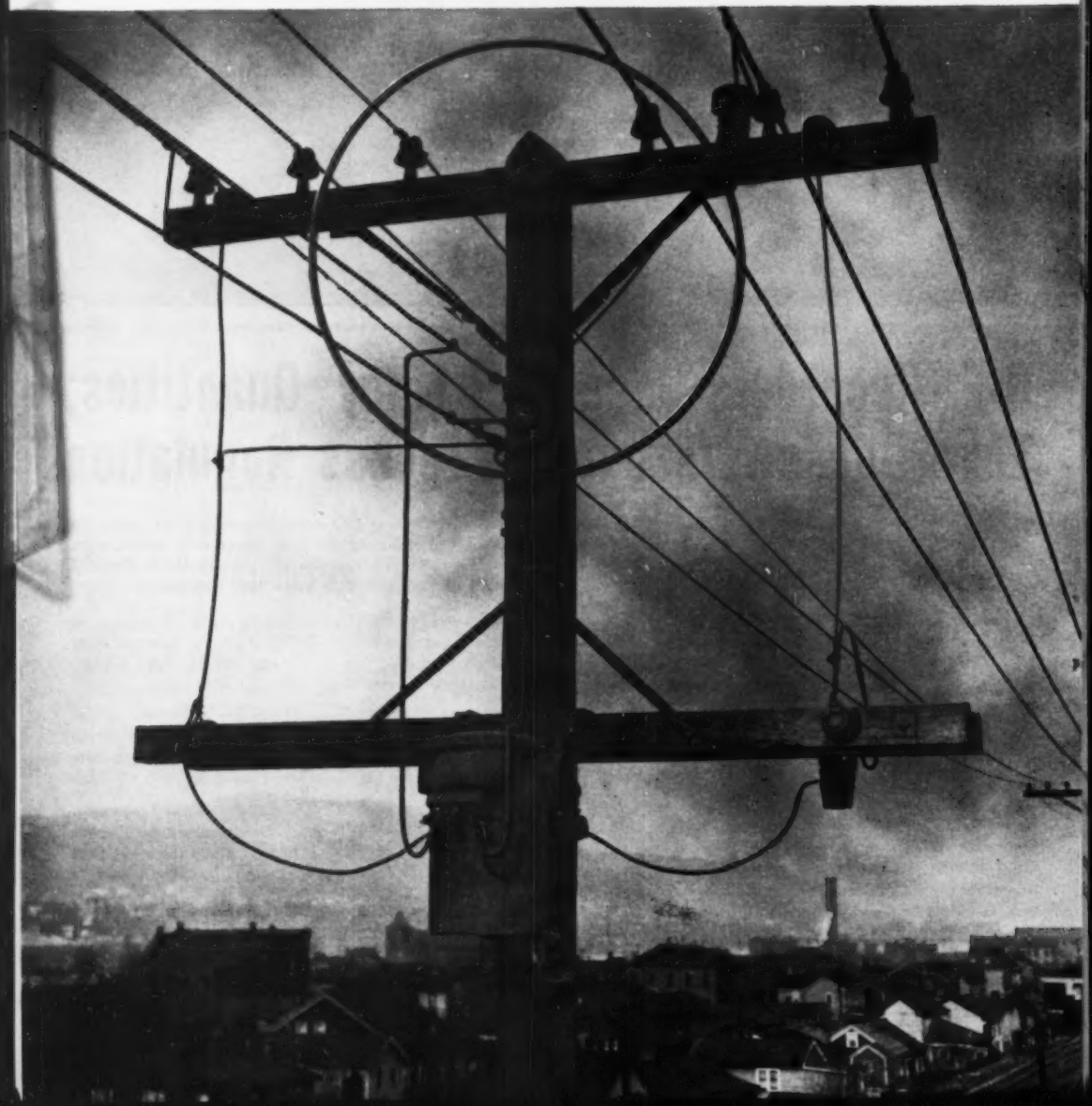
CD DUPLEX RECORDING instruments are available for applications where perfect synchronization between two operations is desired. These instruments employ two separate electric mechanisms for simultaneous recording on a 10-inch-wide chart.

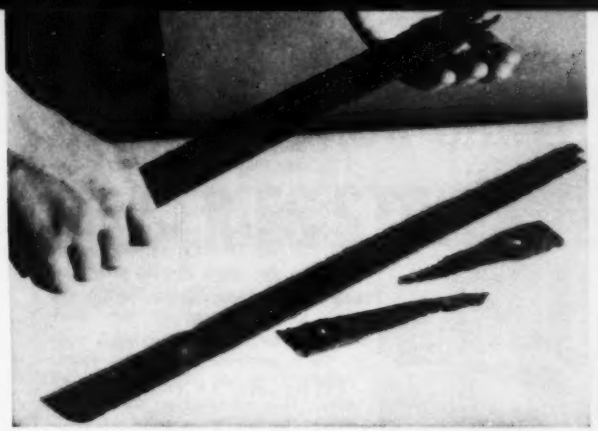
FOR ANY INSTALLATION that requires accurate, convenient recording, a CD recorder is tailored to do the job. Order today from your G-E representative, or, for more complete information on Type CD recorders, write for Bulletin GEC-216A, Section 602-234, General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

SPIRAKORE® transformers
give extra years of service

Crossarm braces eaten away but....





CORRODED CROSSARM BRACES illustrated above provide dramatic evidence of the corrosive effects of industrial smog.

TYPICAL SPIRAKORE INSTALLATION showing corrosive atmosphere successfully resisted by finish on Spirakore transformers.

finish on G-E Spirakore* transformers resists corrosive "industrial smog"

Smoke, soot, grit, and corrosive gases belching from industrial stacks in the Ohio River Valley, create an almost perpetual "industrial smog" that subjects electrical equipment finishes to continual attack.

As a result the local electric utility reports frequent instances where the corrosive atmosphere has eaten completely thru crossarm braces and other pole-line hardware. Yet, even under these conditions, the company obtains excellent service from the finish on G-E Spirakore transformers.

Spirakore finishes stand up because of the *extra* precautions we take in manufacture. We shot blast, completely, each transformer tank. And we use zinc paint *under* all parts to be welded. Then, we apply two *baked-on* coats; a rust-inhibiting primer; and a finish coat of Melaglyp, a superior synthetic resin paint made with melamine-modified Glyptal* alkyd-resin.

Just one of many Spirakore advantages. With G-E Spirakore transformers, besides better paint, you get savings in size and weight due to recent improvements in core-steel quality and construction methods. You get improved impulse strength. You get sealed-tank construction for longer transformer oil life, and improved accessibility even with complete sealing.

For complete information on these and the many other reasons why G-E Spirakore transformers give extra years of service write for Bulletin GEA-4885 and GEA-5400. *General Electric Company, Schenectady 5, N. Y.*

*Registered Trademark of the General Electric Company

BETTER FINISH on Spirakore transformers results from melaglyp paint, a superior synthetic resin paint developed in General Electric laboratories.

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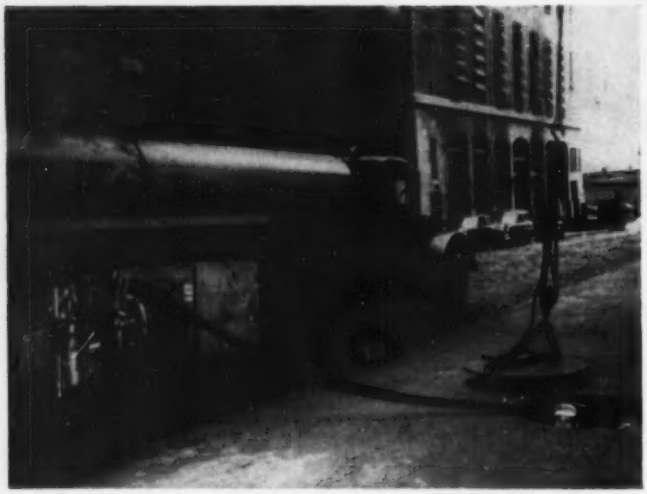


TANK TRAILER TRANSPORTS 3,700-gal of lubricating oil without contamination or drum handling, from three refineries to seven electric generating stations in greater New York City

Con Edison Delivers Oil by Tank-Truck

L. K. MURPHY, Purchasing Agent, Consolidated Edison Co of New York, Inc

Exclusive function of this tank trailer is transportation of lubricating oil for the main turbine-generator units in the seven electric generating stations of Consolidated Edison system located throughout New York City.

Oil is supplied from three source refineries in the greater New York area. Tests revealed no reaction between the oils in question. Accordingly oil from one refinery can be carried satisfactorily in the tank after oil from another refinery had been hauled.

The tank trailer is designed for operation with tractors in the Company's transportation service. It is constructed in accordance with the requirements of the Fire Dept of the City of New York for transportation of No. 5 and 6 heavy oil, and is certified to conform with the New York and New Jersey State Highway and Interstate Commerce Commission specifications.

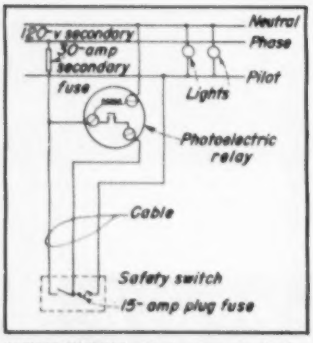
This equipment consists of one 3,700-gal steel double-compartment, single-axle, semi-trailer tank. The tank has two-compartment construction, moisture and vapor proof with suitable vents, manholes, ladders, gages and other accessories. It is 25 ft 2 in. long, 8 ft wide and 8 ft 8 in. high overall, has four disk wheels, dual rear tires and a 30-in. heavy duty fifth wheel built to receive a single kingpin.

Supplying Consolidated Edison's steam-turbine lubricating oil requirements by means of bulk tank-truck delivery has shown a gross saving of $10,346 for a 12-month period. A combination tractor and tank trailer is used.

Performance data indicates a net saving of $8,357 with trailer operating and maintenance costs at $1,989. The gross savings accrued as (1) a result of the oil price differential between drum and bulk tank-truck delivery, (2) the reduction in the cost of handling individual drums in the station storage-tank filling operation, and (3) the elimination of the empty-drum return procedure with its attendant numerous clerical and accounting expenses.

Capital expenditures required to effect the savings was $9,886. It includes the tank-trailer's initial purchase cost of $8,636 plus the station storage-tank piping alterations involved in going to this system.

Fused Switch Aids Patrol of Street Lights



SAFETY SWITCH with fuse permits daytime detection of defective street lamps

C. C. DARRAH, Asst District Manager, and W. D. COX, General Foreman, Appalachian Electric Power Co, Beckley, West Virginia

To permit the same maintenance-patrol procedures for multiple-circuit street light systems as with series systems, a fused safety switch was connected with the photoelectric relay and pilot circuit as shown. During routine daytime patrol of street lights, the maintenance man first closes the switch to ascertain if all lights are burning properly. The fuse will blow if a lamp fixture is defective. But the fuse may be replaced easily from the bed of the maintenance truck or by using a short step-ladder. The safety switch is opened while a defective lamp is removed or replaced with a long stick.

A fused safety switch connected as illustrated provides the following advantages:

1. A convenient means of switching photoelectrically controlled street lights on and off in daytime during patrol.

2. Convenient location of fuse for easy replacement.

3. Easier means of disconnecting street lights at night in case of a national emergency, by pulling the con-

(*Continued on page* 104)

HOW G-E EQUIPMENT SAVES YOU MORE ON SERIES STREET-LIGHTING SYSTEMS

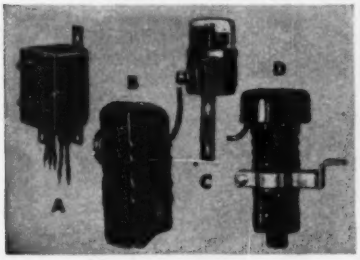
- ***Get optimum lamp performance***
- ***Save costly man hours in servicing . . .***

WITH G-E CONSTANT CURRENT TRANSFORMERS

G-E TYPE RO TRANSFORMER

You reduce operating expenses with G-E Constant Current Transformers because they give exceptionally fine control of secondary current from short circuit to full load . . . assuring maximum lamp life. They compensate instantly for even small changes in load or applied voltage, maintain low starting surge. They're easy to install, maintain their regulation with up to 5 degrees rake, and they're constructed for years of dependable, low-maintenance service.

Illustrated is the Type RO; normal power factor outdoor automatic current-regulating transformer; ratings 5 to 30 kw. Other G-E constant-current transformers: ROC, outdoor, high pf, 5 to 30 kw; RF, station-type, air-cooled, normal pf, 15 to 50 kw.



- ***Protect your circuits***
- ***Reduce operating costs . . .***

WITH G-E CONSTANT CURRENT CONTROL DEVICES

A Type J-1 Protector—provides protection from the hazards of open circuit conditions.

B Fuse Cutout—for primary fault and surge protection.

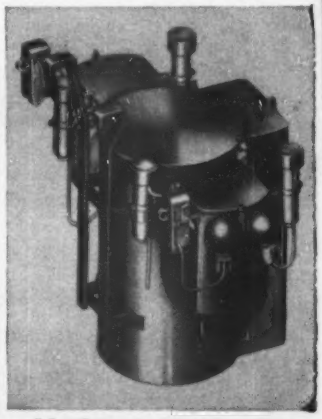
C Type P-1 Photoelectric Relay—low cost control automatically turns lighting circuits on at dusk, off at dawn.

D Pellet Lightning Arrester—for protecting both primary and secondary sides of transformers.

E Type E-1 Controller (not shown)—heavy-duty solenoid-operated oil switch to control transformers.

- ***Cut installation time and expense . . .***

WITH G-E "PACKAGED" REGULATORS



G-E SUBSTATION-TYPE REGULATOR

You reduce installation time and conserve pole space with G-E "packaged" Substation Type Constant-Current Regulators (illustrated at right). Available in 15, 20, 25, and 30 kw ratings, these "packages" contain all protective and controlling elements for efficient, economical series street-lighting operation where 120 V, 60 cycle control power is available. They are factory assembled and can be put into service simply by connecting power and control leads. Each component is readily accessible for servicing.

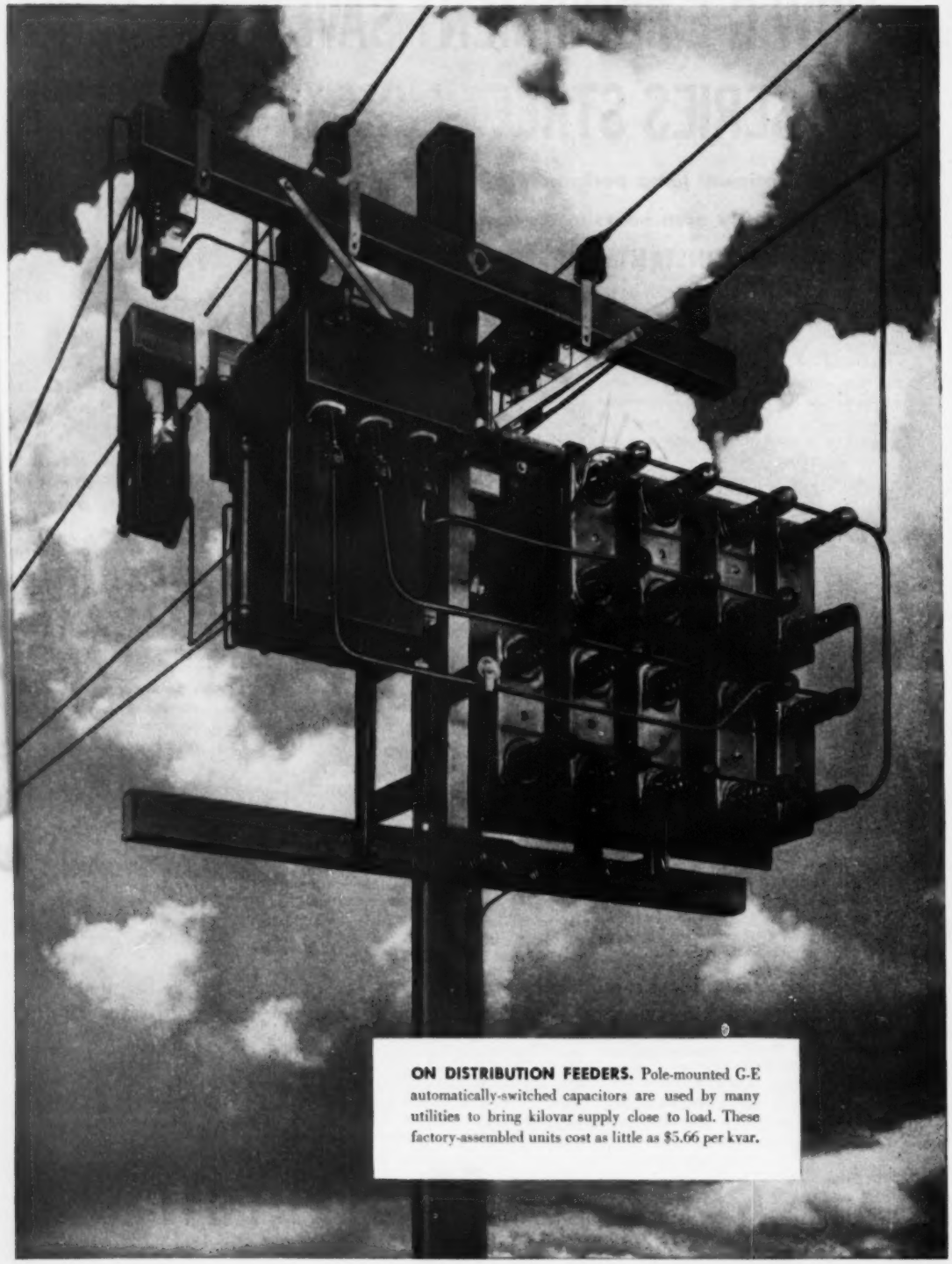
- ***Reduce planning, purchasing costs . . .***

WITH G.E.'s COMPLETE LINE OF EQUIPMENT

You can get all the equipment and devices you need for your series street-lighting systems from G.E.

Moreover, G-E lighting engineers will be glad to help you plan for your street-lighting needs. For information on any of the above equipment, or on G-E engineering service, write *Section 452-131, General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC



ON DISTRIBUTION FEEDERS. Pole-mounted G-E automatically-switched capacitors are used by many utilities to bring kilovar supply close to load. These factory-assembled units cost as little as $5.66 per kvar.

Peak-load capacity released quickly economically by G-E switched capacitors

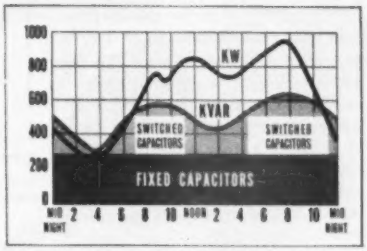
Capacitor equipments can be supplied on short delivery . . . some at a cost of less than $6.00 per kvar . . . installed in a matter of hours

Capacitors continue to provide one of the fastest, cheapest ways to release system capacity. By raising voltage levels and reducing system current for a given load, they can free the system for the delivery of more kilowatts—at a fraction of the cost—and in a fraction of the time—it would take to add new system capacity.

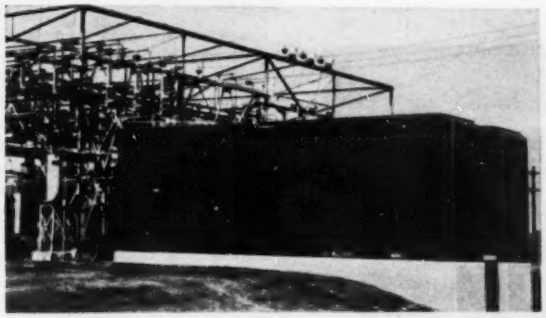
Where you have already installed a high percentage of fixed capacitors—or where your kilovar loading varies widely in any 24-hour period—it will pay you to investigate the use of switched capacitors to alleviate peak conditions.

Automatically-switched General Electric capacitors can be supplied on short delivery—for as little as $5.66 per kvar. They can be installed on your distribution feeders or at the substation—in a matter of hours. And they provide one of the least expensive methods of releasing system capacity.

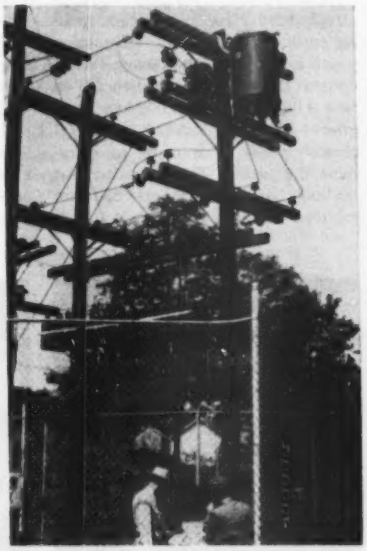
For information on how switched capacitors can help *you* to meet today's climbing loads, call your nearest G-E Apparatus Sales Office. Or write to Section 407-36, *General Electric Company, Schenectady 5, New York.*



FLEXIBLE KILOVAR SUPPLY. Where kilovar loading varies widely in any 24-hour period, G-E switched capacitors can supplement fixed capacitors in providing economical kilovars. (Ruled area shows kilovars furnished by synchronous condensers or system generators.)



AT THE SUBSTATION. General Electric switched capacitor equipments can be used in large banks to supply bulk kilovars. Completely-enclosed equipments like this 5100-kvar, 13,200-volt bank installed by Metropolitan Edison Co., now cost as little as $7.00 per kvar.



LOW COST SWITCHING. A G-E Type B-1 switch plus capacitors and hangers as used in this 600-kvar, 4-kv capacitor bank by Kentucky Utilities Co. is only $5.47 per kvar.

GENERAL ELECTRIC

Fused Switch

(*Continued from page* 100)

venient safety switch fuse.

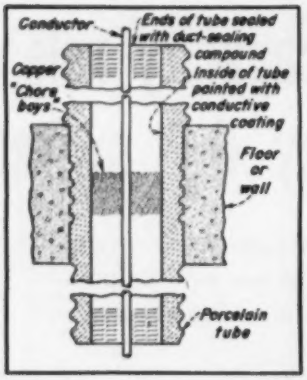
4. The same maintenance procedure as for series street lighting systems.

Safety switch is mounted on photoelectric-relay pole about 8 ft above base. When switch is closed, pilot wire is energized, permitting detection of faulty lamps. The safety switch fuse is smaller than the one in series with the photoelectric relay for its protection. Currently used in this district are 30-amp, 125-v safety switches listed at approximately $5.85 each. An extra terminal is provided easily by inserting a small solderless lug beneath the knife-switch leg. A standard cable having three insulated No. 8 (or No. 6) conductors and one ground wire is desirable for pole connections.

Bushing Modifications Reduce Corona

GEORGE R. DEINEMA, Northern States Power Co, Minneapolis

More recently designed bushings usually have a conducting glaze coating on the inner surface of the bushing which is applied at the factory. When corona trouble was experienced on two 4,000-amp, 1,500,000-kva compressed air circuit breakers purchased recently, tests were made to determine the cause. They revealed that bushings on the breakers had not received the proper glaze treatment and bonding clip have been omitted.



COPPER CHORE BOYS were used to reduce corona in bushings which were not glaze-coated

Trouble was corrected by installation of copper "chore boys" in each bushing to bond the conductor to the bushing.

Tests made after installation of these devices showed that the desired results were achieved. The breakers were then put back into service and have operated satisfactorily.

Porcelain bushings that have an air space between the conductor and the porcelain are subject to non-uniform fields which cause spot deterioration probably as a result of ionization. In bushings where this air space is not a necessary part of the installation a conducting paint has been applied to reduce ionization.

Staple Puller Proves Time and Material Saver

CHILTON B. JUDD, Groundman, Indiana & Michigan Electric Co, Muncie, Indiana

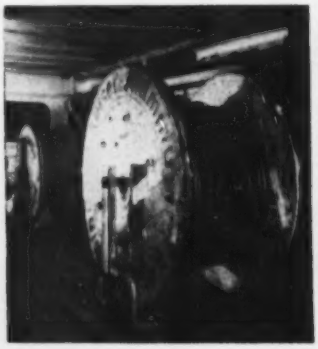
The staple puller illustrated is an aid in pulling wood moulding staples from creosoted pine poles. Ground wire moulding which costs over $35 per 1,000 ft, or an average of $1 per grounded pole, can be mostly salvaged for re-use. Approximately 100 grounded poles per year are removed or replaced in this vicinity and the ground wire moulding can be transferred if it can be removed from the old pole in good condition. The value of material saved with four staple pullers during the first year is expected to be substantially greater than the cost of the pullers. Saving of time by linemen is also an advantage.

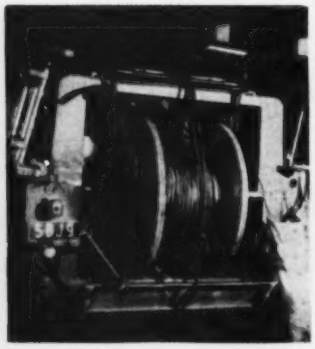
STAPLE PULLER facilitates removal of a 3-in. staple from creosoted-pine pole

Pulling staples from cedar poles was not difficult. On treated pine poles the moulding was often badly damaged or it was necessary to cut the staple with bolt cutters and then to bend them back to permit removing the moulding.

The staple puller removes 1 x 3-in. staples quickly and easily and scarcely any more time is required to remove stubborn ones.

Ordinarily the hook is forced under the staple by pulling down on the handle, but on stubborn staples the top of the hook can be tapped with hammer while bearing down on the handle. The hook may cause a ⅛-in. groove in the moulding but this is not serious and does not prevent re-use.





Handle Service Cable Reels Easier

When three-strand service-drop wire was put into use recently by the Toledo Edison Co reel handling presented a problem. One crew developed a makeshift solution, left. When he saw this, John Peck, foreman in the garage, recognized the problem and developed the neat and efficient device shown in the figure on the right.

Let's *Look at* the "MK-40" *Contacts*

Thruout the entire range, from 400 to 5000 amperes and from 7.5 to 230-kv., the "MK-40" has many outstanding features, all essential to give better, smoother and easier operation. Most vital of these are the high pressure silver-to-copper contacts at both ends of the floating tubular blade—the simple and logical way to eliminate flexible shunts. Their design is of primary importance on an outdoor air switch exposed to year-round weather and corrosive atmospheric conditions. All parts are in plain view for visual inspection.

Plan view of 1200 ampere "MK-40".

Close-up showing multiple leaf pressure applying springs and separate current carrying contact shoes.

Arrangement of contact shoes and springs at hinge end is identical to the contact end.

Ask for Publication 4807

ONLY THE "MK-40" HAS ALL THESE FEATURES

1. Identical high pressure contacts at both ends of the blade are backed by sturdy beryllium alloy springs. Current carrying function is independent of the pressure applying members to take full advantage of the electrical and mechanical characteristics of the materials used.

2. Large spring deflection maintains constant contact pressure over a long period of years. There are no other springs or moving contact surfaces; no small parts.

3. Current interchange surfaces are reduced to an absolute minimum. Rolled or drawn sections are used. Hinge pins curry no current.

4. Contact material is a good heat conductor with ample volume to carry away heat generated under short circuit.

5. Metals at the point of contact are silver-to-copper to resist corrosion and abrasion.

Plus of course—smooth ease of operation with blade under full control at all times; locking in both opened or closed positions.

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHES SPECIFY THE "MK-40"

DELTA-STAR ELECTRIC COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

2437 Fulton Street · Chicago 12, Illinois

DISTRICT OFFICES IN PRINCIPAL CITIES

Properties of Lightning Strokes

Natural lightning and protection data summarized from studies for power system protection

E. L. HARDER, Consulting Transmission Engineer
J. M. CLAYTON, Central Station Engineer
Westinghouse Electric Corp, East Pittsburgh, Pa.

Propagation Velocities in Stroke Channel

	Ft per Microsec Range	Ft per Microsec Avg	Percentage of Speed of Light
Downward pilot streamer	0.25–3.0	0.5	0.05
Return streamer	40–500	100	10

Apparent Surge Impedence of Arc Channel Viewed from Earth Terminating Point Based on Velocity of Return Streamer, 5,000 ohms

Stroke Currents to Transmission Lines

1% over 111,000 amp*
5% over 63,000 amp
10% over 50,000 amp
20% over 33,000 amp
50% over 14,000 amp
70% over 9,000 amp

* Maximum recorded: 218,000 amp

Tower Currents (600- to 1000-ft spans)

1% over 62,000 amp*
5% over 48,000 amp
10% over 33,000 amp
20% over 27,000 amp
50% over 10,000 amp
70% over 8,000 amp

* Maximum recorded: 135,000 amp

Distribution-Type Arrester Currents

1% over 21,000 amp
5% over 9,000 amp
20% over 3,000 amp
50% over 1,500 amp

Station-Type Arrester Currents

1% over 9,000 amp
5% over 4,000 amp
20% over 1,800 amp
50% over 800 amp

Wave Fronts of Direct Strokes

8% exceed 6 microsec
23% exceed 4 microsec
69% exceed 2 microsec
90% exceed 1 microsec

Recorded range from less than 0.5 to over 10 microsec
50% of stokes over 30,000 amp exceed 4 microsec

Wave Fronts of Arrester Discharge Currents

10% exceed 6 microsec
17% exceed 4 microsec
50% exceed 2 microsec
70% exceed 1 microsec

Steepest high discharge current recorded: 5,000 amp in 1 microsec

Rate of Rise of Direct Stroke Currents

5% over 48,000 amp/microsec*
10% over 25,000 amp/microsec
20% over 17,000 amp/microsec
50% over 8,000 amp/microsec

* Maximum recorded rate of rise: 45,000 amp/microsec

Time to Half Value of High-Current Components

	Direct Strokes, %	Distribution Arresters, %	Station Arresters, %
Over 80 microsec	96	84	65
Over 40 microsec	57	50	20
Over 60 microsec	14	31	7
Over 80 microsec	5	17	4
Avg. time microsec	43	40	27

Duration of Individual Stroke Components

Duration of Current Exceeding 50 amp	Direct Strokes, %	Distribution Arresters, %	Station Arresters, %
Over 50 microsec	100	98	78
Over 200 microsec	78	73	18
Over 1000 microsec	23	20	3
Over 10,000 microsec	10*	3	2

* Longest direct stroke components exceed 0.3 sec

Number of Components per Stroke

Direct Strokes	Arrester Discharges
55% at least 2 comp	34% at least 2 comp
17% at least 6 comp	8% at least 6 comp
Average: 2.2 comp	Average: 1.5 comp
Most recorded: 40 comp	

Total Duration of Complete Stroke

Direct Strokes	Arrester Discharges
89% over 0.001 sec	19% over 0.001 sec
45% over 0.1 sec	17% over 0.1 sec
10% over 0.5 sec*	6% over 0.5 sec

* Maximum recorded: over 1.5 sec

Charges in Direct Strokes

5% exceed 130 coulombs*
20% exceed 63 coulombs
50% exceed 25 coulombs

* Maximum recorded: 160 coulombs
Charge through arrester rarely exceeds 1 coulomb

Polarity — 90% of all lightning strokes are negative (those that lower negative charge to earth).

Frequency of Strokes (Isokeraunic Level (IKL) = 30)

To Transmission Lines	1 per mile per yr
To Small Substation	1 in 10 years
In Open Country	10 per sq. mi. per yr.

Higher isolated structures:

Height, ft	No. Times Struck	Height, ft	No. Times Struck
100	0.4 per yr	800	4.4 per yr
200	0.8 per yr	1000	10 per yr
400	1.5 per yr	1200	20 per yr

Stroke Currents Required to Flash-Over Shielded Transmission Lines and Outage Probability[1]

No. Insulators (or equiv.)	Midspan Separation, ft	Stroke Current for Flash-over*	Outages per 100 mi/yr*
6	17	73,000 amp	2.5
8	19	80,000 amp	1.9
10	25	97,000 amp	0.9
12	32	116,000 amp	0.5
16	48	150,000 amp	0.3

* Based on 1000 ft span, 10 ohms tower footing resistance, IKL = 30, 0.1% shielding failures

Shielding Angle to Limit Direct Strokes to Phases to 0.1% of Total

Height of Conductor, ft	Height of Ground Wire, ft	Shielding Angle*, deg
25	40	40
50	65	39
100	115	28

* Angle made with vertical by plane through ground wire and phase wire

Distance from Transformer to Lightning Arrester (Transformer Connected to Overhead Line)[2]

System Voltage, kv	Line Construction or Insulation Level	Maximum Distance*, ft
69	Wood	22
69	Steel	32
138	Wood	33
138	Steel	46

* With full transformer insulation and 100% station-type arrester

Maximum Cable Lengths for Cable-Connected Equipment*[3]

Equipment Basic Insulation Level, kv	Lightning Arrester Rating**, kv	Station-Type Arresters, ft
60	3	NL†
60	6	NL
95	9	NL
95	12	NL
95	15	80
150	20	NL
150	25	90

† No limit to cable length
* Liquid-filled transformers and dry and compound-filled instrument transformers
** Rating of arrester at junction between cable and overhead circuits

References:
1. "Transmission Line Design and Performance Based on Direct Lightning Strokes" by E. L. Harder and J. M. Clayton, *AIEE Transactions*, Vol. 68, Part I, 1949, p. 439–49.
2. "Co-ordination of Lightning Arrester Location with Transformer Insulation Level," by R. L. Witzke and T. J. Bliss, *AIEE Technical Paper* 50-153, 1950.
3. "Surge Protection of Cable-Connected Equipment," by R. L. Witzke and T. J. Bliss, *AIEE Technical Paper* 50-83, 1950.

Connect the service leads . . . plug in the meter . . . *That's all!*

The STU Heavy-Duty Socket

There's no need to devise special metering facilities for heavy current applications when you use Westinghouse Transockets. All components are in place . . . complete with secondary wiring—ready for installation . . . all in a single package! Just connect the service leads, plug in the meter . . . that's all.

The STU High-Capacity Socket lets you utilize the full inherent capacity of Westinghouse 50 ampere meters, when installed on services using #4/0 wire. It's now available for polyphase as well as for single-phase applications.

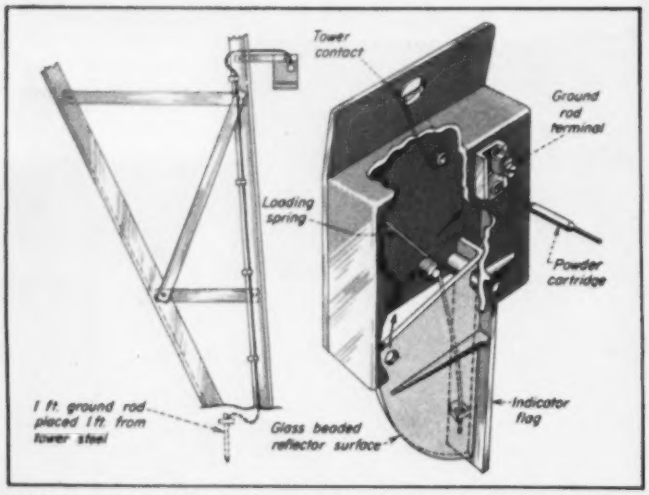
The STS Transocket combines the socket and Type MR current transformers in one compact enclosure . . . handles heavy loads up to 400 amperes.

Both units are ready to install . . . inexpensively . . . easily . . . and take standard S-Type meters.

Here's real help! The Westinghouse "Meter Socket Selector," B-5284, makes it easy for you to select the proper socket for any application. It's 20 pages, fully illustrated, covering all types of service . . . all capacities. To get your copy, write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-40426-A

Westinghouse

METERS



FLASHHOVER INDICATOR drops plastic flag into view when current caused by lightning and power flashover explodes powder charge in glass tube acting as pin holding flag.

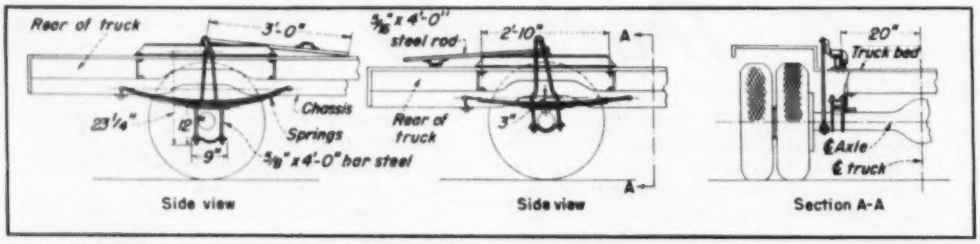
Visual Indicator Spots Flashovers

W. E. SCARBOROUGH, Transmission Design Section, Bonneville Power Administration, Portland, Ore.

For clear and dependable visual indication of towers where flashovers have occurred, Bonneville Power Administration uses a plastic indicator with a glass beaded yellow plastic flag. The flag is dropped out of the plastic case when a potential from the tower leg to ground explodes a charge in a glass capsule. Indicator is positive in operation for both lightning and power flashovers. Flag is readily visible by day or night from either air or ground patrols. Prior to the development of the flashover indicator, it was necessary to climb each tower in a section of a line after an outage.

The indicators are generally used on steel towers only. Lightning usually slivers or gouges a wood pole slightly along its surface leaving a mark which can be spotted from the ground or by air patrol. Damage to steel towers, on the other hand, is generally confined to the insulator. These burned spots may expose the white porcelain, but the spot is comparatively small and difficult to see from a distance.

The flashover indicator is about 4-in. square and 1-in. deep. It contains a flag, pivoted on one lower corner, which is held inside the box by a powder cartridge made of a small glass tube. Indicator is fastened to the leg with one end of the cartridge making contact with the tower steel through a metal strap riveted to the box. The cartridge passes through a hole in the flag and rests on tubular rivets, one of which fastens a small solderless lug to the front of the box. An insulated wire connected to the solderless lug extends to a short separate ground rod about 1 ft from the tower steel.



SPRING-COMPRESSOR, shown in normal and locked position, is used to stabilize ladder on service truck

Spring Tie-Downs Stabilize Truck Ladders

J. R. CALLICOAT, Transportation Supervisor, Appalachian Electric Power Co, Huntington, West Virginia

The need for longer truck ladders and more freedom in positioning them was created by modern curb-line street-light installations with high fixtures.

Safety, simplicity of operation, its time-saving features, and moderate cost are the chief advantages of a ladder stablizer used on streetlight service trucks in the Huntington territory of the company.

Satisfactory results in stablizing the ladders have been obtained for about a year by the simple method illustrated. Here the rear truck springs are compressed enough when ladders are used so the truck body will be relatively rigid with the loaded ladder in any position.

When the truck is positioned for use of the ladder, a man on the truck can easily and quickly swing the spring-compressing lever 180 deg to its self-locking position, without leaving the truck bed. Spring on both sides of the truck can be compressed or released in less than one minute. This device is a great advantage when the truck is not initially located in the best position and must be moved, because that can be done without unlocking the springs. If the operator lowers his ladder and inadvertently drives off without unlocking the springs, damage which would be done with any system of jacks is avoided.

Spring compressors for one truck were constructed and installed with a total expense of $49, including ma-

LICK wire letdowns PICK jacketing of VINYLITE Plastics

When dependability and low cable cost are a must—trust jacketing of VINYLITE Brand Plastic with BAKELITE polyethylene insulation. These materials top them all for trouble-free performance . . . longer service life for signal cables.

Some compounds are particularly formulated to resist hazards encountered during installations at low temperature . . . stay flexible down to minus 67° F. —resists heat up to 140° F. Under the ground or in corrosive atmospheres, they stand up to their job . . . minimize maintenance . . . step up wire efficiency. That's because VINYLITE Plastics are unaffected by oils, greases, alkalies, most strong acids, sunlight, flame, age and mildew. Their smaller dimensions save space; their smooth surface, easy stripping and splicing speed installation. Their lasting colors provide permanent coding.

Now, more than ever, is the time to investigate these reliable materials. Write for a representative list of suppliers. Address Dept. MJ-28.

MEMO TO WIRE MANUFACTURERS

Write for a free copy of Kabelitems No. 58 which presents the municipal wire and cable specifications which thermoplastic materials must meet. This reprint of the International Municipal Signal Association's report on the various properties of thermoplastic materials gives the requirements which must be met for their incorporation in municipal applications . . . standards met by VINYLITE Brand Plastics. Send for your copy today!

Vinylite BRAND **PLASTICS**

TRADE MARK

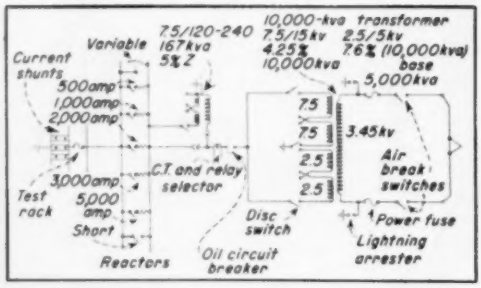
BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

terials which cost less than 30% of the total amount.

The stability of the ladder in the locked positions might be questioned but no excessive waver under this condition has been experienced. In fact the rear jacks installed on this truck while experimenting have never been used because they do not seem necessary for stabilization, although we have left them in place on the truck.

Safe top ladder loading should be determined to cover the length of the ladder and weight of the truck.

LAMINATED TIMBER CONSTRUCTION was used for substation. It is 34-ft high, 44-ft long, and 37-ft wide and has two transformers



TEST SUBSTATION was designed to duplicate actual operating conditions. Numerous test voltages can be obtained from transformers

Test Substation Aids High Voltage Research

The James R. Kearny Corp has recently completed its 34.5-kv, 10,000-kva substation. Designed for testing power transmission equipment under high-current, high-voltage conditions found under actual operating conditions, it will facilitate research and development aimed at bettering operating practices. The substation was built at a cost of about $250,000.

The main substation transformer is rated at 10,000 amp at 15,000 v, and was designed to provide real line-fault conditions. Back-up short circuit capacity at the substation will be 445,000 kva, line-to-line. To handle the extremely high short circuit currents the primary bus was made of 2-in. IPS copper, and the low voltage bus of ventilated tubing, 4-in. square and ½-in. thick.

A special surge generator is being built for use in firing lightning arresters to initiate power follow current from the test station. The generator will have an output in excess of 15-kv and will be triggered electronically to control that part of the wave on which the arrester is fired.

For safety and convenience when viewing tests, there is an instrument house with a 12-ft length of bullet-proof glass facing the test bay. Control leads for the relaying, interlocks, breaker and motor-operated disconnect switch controls are fed underground into the instrument house. A cyclone fence, grounded separately at various points, protects the substation and instrument house.

Seven Devices Ease House-Service Installations

J. H. SEITZ, District Serviceman, The Ohio Power Co, Ottawa, Ohio

Service-truck accessories have been developed for aiding installation of house-service brackets and cable. Their advantages include savings in time and labor. The devices are:

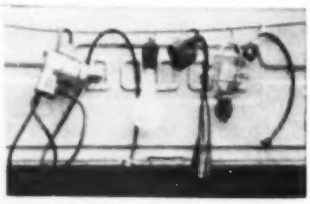
1. Electric drill with detachable hook for hanging on ladder rung; accommodates ¼-in. and smaller bits.

2. Rubber socket extension lamp with guard and hook.

3. Rubber socket with hook for 200-w lamp used in clocking meters.

4. Polarized twist-lock connector with attached rubber socket for fuse, and also hook for hanging assembly on service wire or switch box; 3-wire 10-amp polarized connector; 6-amp fuse.

5. Rubber-shielded polarized spring clips attached by three short rubber-covered wires to polarized twist-lock connector for obtaining power from service wires or switchbox and grounding drill; clip shields are identified by color: black for "hot" wire; white for neutral; green for grounding circuit.



SERVICE DRILL with 3-wire cord, polarized twist-lock connector, insulated spring clips, extension lamp and 200-w lamp for clocking meter are aids in house-service installations

6. Portable 3-wire No. 16 rubber-covered cord for carrying polarized power to electric drill and providing reliable ground for electric drill case; 50 ft of cord with polarized plug and socket.

7. Portable cord for attaching to convenience outlet if necessary.

Here is equipment for safely obtaining power for electric drill or extension lamp from service wires or switchbox, with fuse at service end and reliable grounding circuit for electric drill case. Normally the drill is not connected to an ordinary convenience socket because it does not permit grounding of the drill case.

The hook on the polarized-connector-fuse assembly prevents detach-

ALLIS-CHALMERS
INSTRUMENT
TRANSFORMERS

Outdoor current transformer for heavy duty metering, Type KO. Ratings up to 15 kv and 800 amperes.

Outdoor potential transformer, 200 va, Type PWD. Ratings up to 15 kv.

Indoor potential transformer, 200 va, fused or unfused, Type PD. Ratings up to 14,400 volts.

Safety Factor *stepped up!*

BECAUSE OF THIS VACUUM-PRESSURE PROCESS

THE SPECIAL CHAMBER shown above houses a modern vacuum-pressure system for compound-filling Allis-Chalmers instrument transformers. Here the core-and-coil assemblies and compound become a compact unit—with all parts positively positioned for life. And because air and moisture are kept out permanently, insulation strength is retained almost indefinitely.

Here's How It Works

When the door is closed on the core and coil assemblies (preheated before they are placed inside), a combination of high vacuum and Sahara-like heat whisks away all moisture and entrapped air. Soon the assembly is bone dry. Then hot liquid compound—from which air and moisture are removed—is directed into the transformer case. When case is full, vacuum is released. The hot compound is forced into the innermost recesses of the tanked assembly, completely filling all voids. The transformer is then removed to another area for cooling and final finishing.

You Get 4 Big Benefits

The Allis-Chalmers method of compound-impregnating results in a higher safety factor for your instrument transformer . . . giving you these four advantages:

1. High dielectric strength
2. Air and moisture cannot attack insulation
3. Eliminates maintenance of an insulating medium
4. No leakage or contamination

The extra benefits resulting from this compound-impregnating process can save you money. Why not contact your nearby Allis-Chalmers district office today for more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A 3742

ALLIS-CHALMERS

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

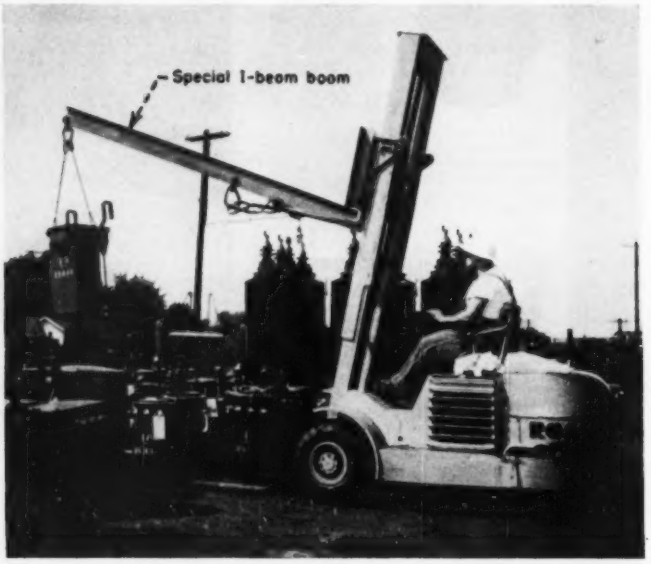
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

ment of clips from service wires or switchbox terminals if the portable cable is pulled excessively. The removable hook on the drill is ⅛ x ⅝ in. strap iron with slotted holes which permit removing the hook by merely loosening the screws. The 200-w lamp is connected to the load side of the meter to ascertain whether the service is properly connected and the meter is in operating condition.

The equipment is suitable for installing brackets and service cables for homes with either ordinary wood siding or asbestos shingles. With the latter, the equipment really pays off because drilling through asbestos material with an ordinary hand-push drill is a slow job. In addition to the electric drill mentioned, a 5/16-in. Carboloy drill is available but it's no load speed of 2250 rpm is too fast for drilling asbestos shingles. This makes the second drill necessary.



Boom Eases Transformer Handling

Transformer handling in Toledo Edison's yard was simplified by building special I-beam boom for a fork lift truck. Lugs were welded to the I-beam so that it could be slipped into place and held securely on the lift truck. With this arrangement it is an easy matter to reach over into the storage area to pick up the desired transformer. Besides saving time and money the I-beam boom takes a lot of the hard work out of handling transformers which can be very difficult when dealing with the larger sizes.

Radio Adjusts Regulator Compensation

W. M. PHILLIPS JR, Distribution Engineer
ROY PETERSON, Substation Maintenance Foreman, The Ohio Power Co, Canton

Existing mobile space radio equipment is being utilized to transmit feeder regulator compensation values to the person making adjustments to maintain the desired voltage at load centers rather than at the regulators.

Initial settings of the single-phase regulators are based on the calculated circuit reactance values, taken from charts or tables. Then readings are taken and recorded at the load center, where potential transformers are attached to each phase, by using a single indicating voltmeter to avoid errors which might be entailed by using different voltmeters. The load-center voltages will usually be in the vicinity of

the desired values, but the voltages between different phase-wires and neutral may differ by several volts, due to differences in reactances of the conductors. These readings are transmitted by space radio to the person at the regulator who adjusts the reactance settings of each single-phase regulator until the desired voltages are obtained at the load center.

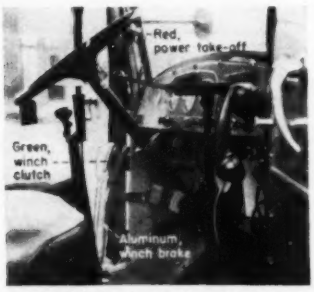
Special radio equipment is not set aside for this work because portable radios cost about $275, and because mobile radio units cost about $750 installed, exclusive of car which with all appurtenances may cost $2,500 to $4,000. Any mobile radio equipment available is utilized.

Color Scheme Identifies Winch Controls on Trucks

J. H. WINTER, Technical Assistant, Electric Distribution Dept, Consolidated Gas Electric Light & Power Co of Baltimore

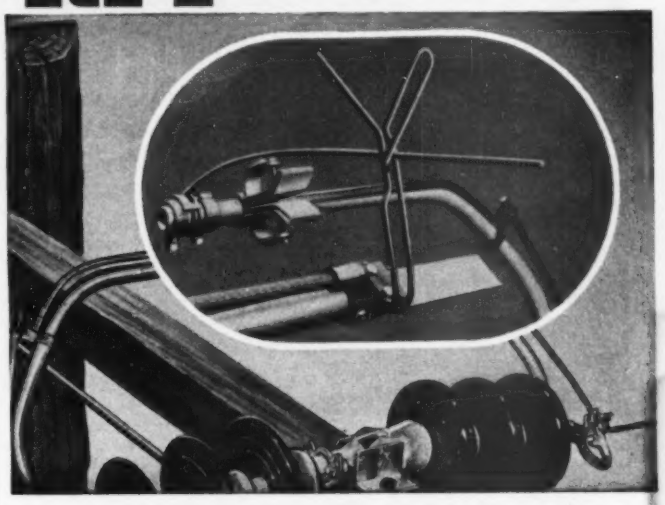
Training of truck operators is simplified and possibility of committing operating errors is reduced in Consolidated Gas Electric Light & Power Co winch trucks by use of standard color markings for winch controls. Effect of the color scheme has not been evaluated on a quantitative basis but the company is satisfied that the desired objectives have been reached.

Color scheme used is this: red for power take-off; green for clutch; aluminum for brake. In addition to aiding in the training of operators, the markings enable them to drive all vehicles regardless of the fact that winch controls are not always located in the same position. Coloring of these controls was inaugurated approximately 10 years ago by the company. A total of 64 vehicles assigned to Electric Distribution Dept use this scheme.



COLOR SCHEME for winch controls in truck cabs aids operator training and safety.

KPF POLE TOP SWITCHES



Drop 40 miles of 69 kv lines with KPF Quick-Break pole top switch

Operating engineers tell us KPF switches with Quick-Break attachment are the most outstanding air-break switch improvement in 25 years. Before development of this Quick-Break device, pole top switching of 69 kv circuits was limited to some 6 miles of line. Now, operating experience shows that 40 miles of 69 kv line can safely be dropped with this equipment.

The secret of the KPF Quick-Break is a heavy-duty cat's whisker which whips free in a split second as the switch is opened. This mechanism prevents establishment of an arc; thus critical arc length is no problem.

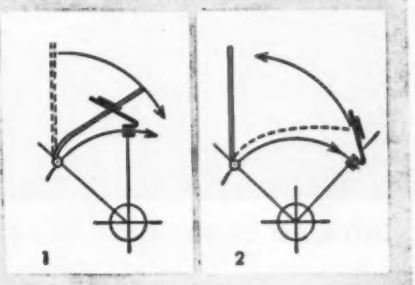
The KPF Quick-Break attachment is simply and ruggedly constructed for low cost, long life and all-weather dependability. It is available for all KPF switches rated 15 to 69 kv.

HERE'S HOW KPF QUICK-BREAK WORKS

1. Spring rod winds to full tension as switch opens.

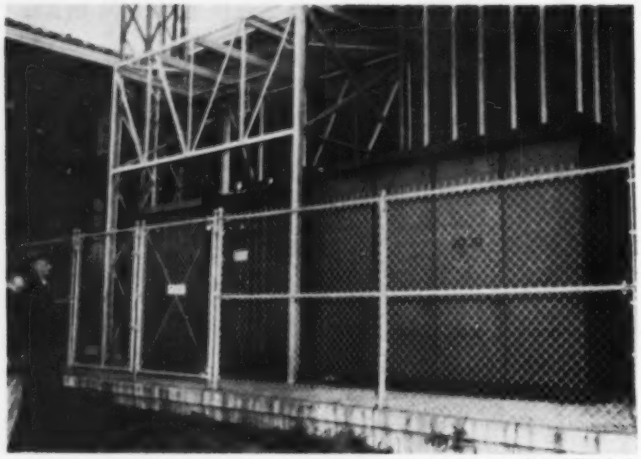
2. Rod springs clear, breaking contact at high speed.

Write for details of KPF Quick-Break attachment and low cost, long-lasting, easy-to-install KPF Switches.



KPF ELECTRIC COMPANY
1624 E. Alpine Avenue • Stockton, California

INDUSTRIAL APPLICATIONS



General Electric Co

LOAD CENTER substations installed at strategic location in plant saved 25% on motor maintenance and 20% on lamp bulb replacements. Picture shows one of the 1500-kva units

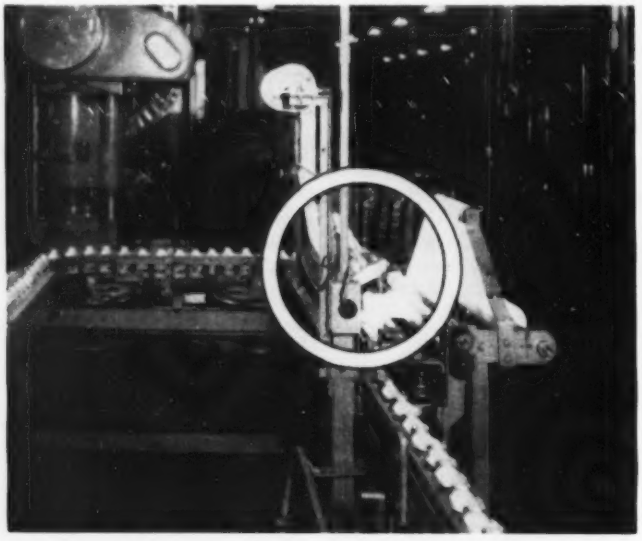
Load Center Substations Improve Service

Savings of approximately 25% on motor maintenance and 20% on lamp bulb replacement have been effected at the Highland Cotton Mill, High Point, N. C., since the installation of five new load center substations a year ago, according to L. M. Young, mill maintenance man.

Company now has sufficient power capacity to increase production of hosiery and underwear yarns by 25,000 to 50,000 lb weekly. Company produces approximately 110,000 lb of yarns per week.

Before the new larger power units were installed, the company had three 750-kva transformers which had progressively become more and more overloaded owing to increases in the mill electrical load. This overload and relatively long cable runs to many of the motors resulted in low voltage at motors, causing them to overheat. Attempts to maintain motor voltage by using higher voltage taps on the transformers caused high voltage during light load periods and resulted in excessive lamp burn-outs.

To correct the situation and to provide additional power for anticipated further increases in mill load, four 1,500-kva and one 750-kva load-center unit substations were installed. The units were so located as to obtain minimum cable runs to the load served.



Infrared Lamp Aids Wax Removal

Wax softening by infrared lamp at Continental Can Co, Mifflin Borough, Pa., has solved a difficult problem of aiding wax removal from tops of beer cans. Insides of some beer cans are coated with wax and any accumulation on their tops must be removed. K. P. Allen, Industrial Power Salesman, Duquesne Light Co, Pittsburgh, Pa.

E. L. Wiegand Co

Comfort Heater Cuts Floor Drafts

Comfort heating with rugged electric radiant heater simply laid on cold floor cuts through floor drafts in open factory area at the A. E. Bausenbach Co, Buffalo, N. Y. 800-w comfort heater is placed just right distance from lathe hand and quickly heats his feet and lower body—an impractical job to do with conventional methods.

There's no instrument to measure value

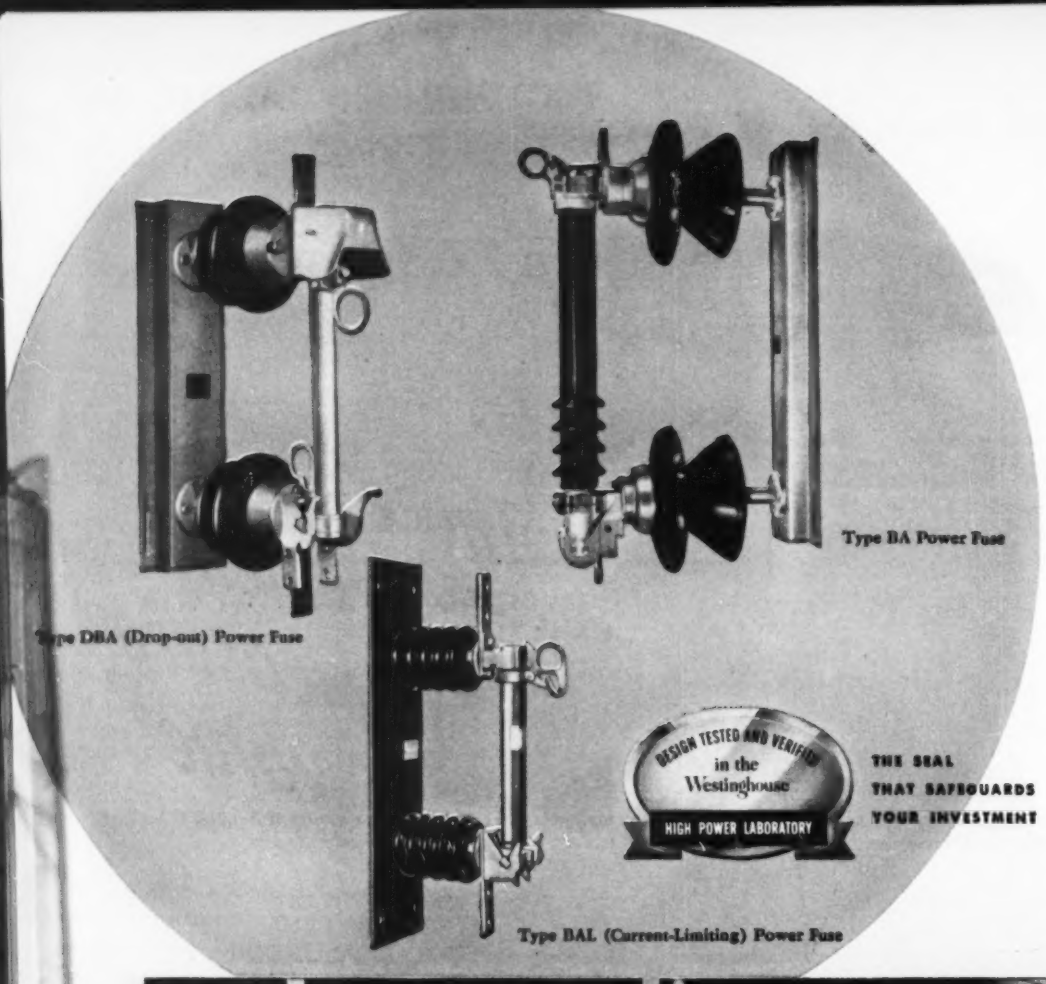
According to national standards, station insulators are measured many ways - size, strength, thermal resistance, dielectric properties. These measurements assure a uniform product among manufacturers - *uniform except for value!* No instrument will tell how long the insulator will give satisfactory performance, yet this is the real measure of your dollar's worth . . .

Confirm this if you wish: the vast majority of O-B station insulators are bought by power companies some of whose records of performance go back as much as 30 years or more. Ignoring all sales arguments, these companies evaluate insulators on their own terms . . . Measured in dollars per year, there is still a bargain in station insulators - O-B!

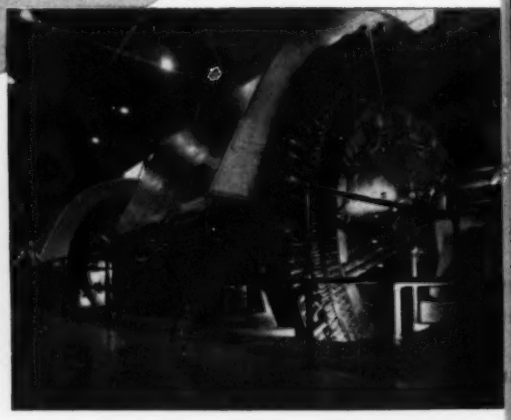
Ohio Brass

MANSFIELD · OHIO

4134-H



In a typical High Power Laboratory test, a Type DBA Fuse is shown interrupting the equivalent of a 3-phase, 1,000,000-kva fault. An instant after the photo was taken, the drop-out element operated, isolating the circuit.



Source of the laboratory's tremendous power are these two 60,000-kva generators. When paralleled, they are capable of delivering a 3-phase fault of 2,500,000 kva, or a single-phase fault equivalent to 4,000,000 kva.

ONLY *CONTROLLED* LABORATORY TESTING CAN PRODUCE THESE RESULTS:

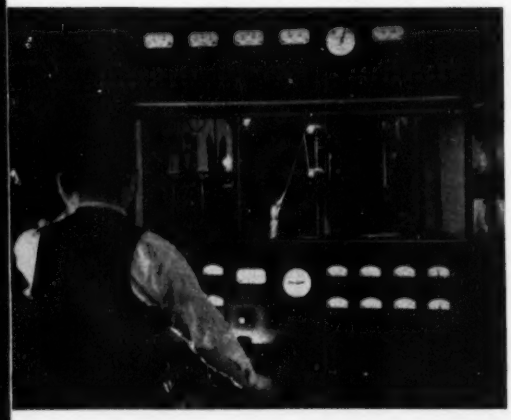
1. Application of Boric Acid Idea to Power Fuses

2. Proved Operation under all Circuit Conditions

In 1931, the Westinghouse High Power Laboratory—already five years old—played a major role in the development of the boric acid fuse. Conducting multiple tests under controlled conditions not available in the field, Westinghouse Laboratory technicians proved conclusively the soundness and superiority of the boric acid interrupting principle. The result is a complete line of low-cost protective devices proved to a degree unattainable by other means of testing. Considering the extent of your investment in fuse-protected equipment, this extra measure of sureness is an invaluable advantage. And it's one you get only when you specify Westinghouse.

Continued High Power Laboratory testing has also widened the application of this economical means of short-circuit protection. From the first Type BA Fuse, low-cost interrupting capacity has advanced with the development of Types DBA (drop-out) and BAL (current-limiting) until now 138,000-volt fuses that interrupt one million kva are available.

FOR COMPLETE INFORMATION on Westinghouse Power Fuses ask for a copy of Booklet B-5469. Contact your Westinghouse representative or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60781



From this control desk, a single operator guides all high power testing facilities. The control room also houses indicating instruments, protective relays, sequencing drums, and oscillographs which simultaneously record as many as eighteen variables.

See "Electrical Proving Ground"

...the dramatic story of the Westinghouse High Power Laboratory in sound and color motion picture. For details, see your Westinghouse Representative, or write: Westinghouse Film Division, Box 868, Pittsburgh 30, Pennsylvania.

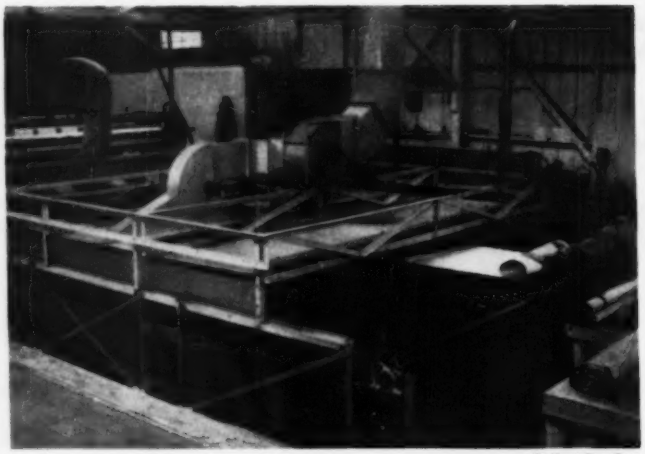
YOU CAN BE SURE...IF IT'S Westinghouse

POWER FUSES

Infrared Radiant Heaters Speed Rug Drying

Tubular radiant infrared heaters have increased heat efficiency and cut oven drying time for non-skid rug coatings at Pierce & Co, Los Angeles, Cal. Material moves through new oven at rate of 6 to 8 ft per min compared with 4 ft per min for old conventional oven. Hot spots prevalent in previously-used oven have been eliminated and heating elements can be safely placed close to the rugs. The latex-base plastic coating is applied in liquid form on backs of rugs and moisture must be driven from emulsion before carpeting can be re-rolled or handled.

Oven has 85,000 w in radiant infrared heaters enclosed in pyrex-glass tubes backed by Alzak-coated aluminum parabolic reflectors. Tubes operate at atmospheric pressure. This factor eliminates any possibility of implosion or explosion.



Radiant Ray Corp

RADIANT INFRARED OVEN eliminates hot spots and permits heaters to be placed close to rugs for drying plastic coating. Conveyor speed has been doubled over previous method

INDUSTRIAL BRIEFS

Cutting steel with electrically produced heat is fastest known means of cutting heavy structural shapes, I beams, H sections, channels, angles, etc, at new steel service plant of Joseph T. Ryerson & Son, Inc, Cincinnati, O. Cutting is done in few seconds without clamping material. Friction saw motor is 200-hp special squirrel cage induction type, 1720 rpm, 480 v, 237 amp, 3-phase, 60 cycle. Steel saw blade in 5 ft 2 in. diam and ⅝ in. thick—with hobbed teeth and attains peripheral velocity of 27,800 ft per min. Friction between saw and steel produces heat and steel is actually melted. Saw teeth are cooled by coolant sprayed on teeth under pressure. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

Shoe drying time has been cut from hours to 3½ min by use of a home-made infrared lamp bank at Clement and Ball Shoe Mfg Co, Baltimore, Md. Oven is open construction and contains 32 lamps totaling 8 kw. Racks containing 24 to 36 pairs of shoes are rolled into the oven and automatic timer is set. The edge ink on soles or the cement soles for bottom finishing are dry in 3½ min. Infrared was selected because of its cleanliness, compactness, and low cost of installation. Ralph C. Young, Industrial Engineering Representative, Consolidated Gas, Electric Light & Power Co, Baltimore, Md.

Oil well pumping by electric motor drive cuts costs by eliminating attendants required by other types of pumping drives—also reducing maintenance at wells in Eucutta and Yellow Creek Fields, Wayne County, Mississippi. The Humble Oil Co has a very efficient system—using a voltage of 830 v which can serve two, three, or more wells from one transformer location. Installations are compact and neat. Motors have time clocks and protective equipment—making them practically automatic. During 1951, the average demand of 134 wells was 9.2 kw each and each used approximately 47,895 kwhr per year. Average revenue for well was $623. F. B. Hewes, Industrial Power Engineer, Mississippi Power Co, Gulfport, Miss.

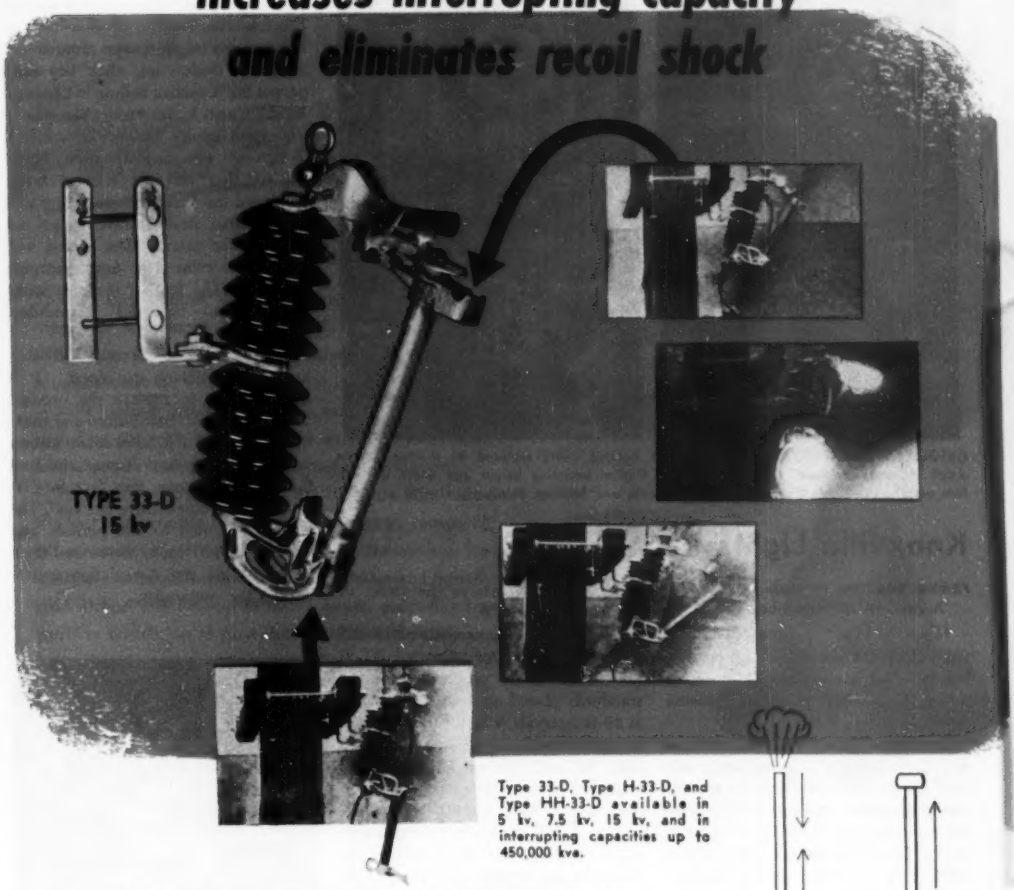
Platen cleaning with a 30 kw salt bath electric furnace saves both time and labor at the West Co, Phoenixville, Pa. Particles of rubber adhering to platens used in making molds are burned out. Job is easier, faster and cleaner than old method of hand scrubbing. L. Albertson, Application Engineer, Philadelphia Electric Co.

Snow removal from an automatic ice cubing machine at the Schory and Schellhase Coal and Ice Co of Canton, Ohio, doubled output and removed an operational hazard. Product's appearance has also improved. Machine saws cubes from 100 lb blocks of ice. Formerly snow from the cuts piled up beyond blade of rotary saw blocking movement of cubes from machine. A 1000-w thermostatically controlled curved strip heater mounted just beyond blade's periphery melts the snow and allows cubes to be ejected from the machine by the centrifugal force of the saw blade. G. W. Craiglow, Industrial Power Engineer, Ohio Power Co, Canton, O.

Heating plating baths with electric immersion heaters has increased production and efficiency and saved critical materials at the Pittsburgh Nipple Works, Inc, Pittsburgh, Pa. Working conditions have improved, fire hazard is eliminated and better product is produced. Change-over from fuel-fired heaters required only small investment since installation has "over the side" hanging electric units. Temperatures of baths are now regulated accurately resulting in great economies in use of nickel, copper and chromium. Heaters total 24 kw. R. I. Lavelle, Industrial Representative, Duquesne Light Co, Pittsburgh, Pa.

DOUBLE VENTING

increases interrupting capacity and eliminates recoil shock



Type 33-D, Type H-33-D, and Type HH-33-D available in 5 kv, 7.5 kv, 15 kv, and in interrupting capacities up to 450,000 kva.

Stopped by a high-speed camera, the principle of DOUBLE-VENTING fuse holders is graphically illustrated in the cycle of operation shown in the series above.

DOUBLE-VENTING allows gases generated by the arc of the rupturing link to be expelled from both ends of the fuse tube. This results in greatly accelerated relief of gas pressure within the tube. Since the two escaping gas columns oppose and balance each other, recoil from the high velocity of expelled gases is eliminated.

The DOUBLE-VENTING principle employed in Southern States cutouts reduces the possibility of damage from recoil and allows interruption of greater values of fault currents.

Write for Bulletin No. 178-D

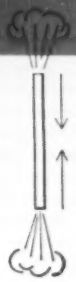


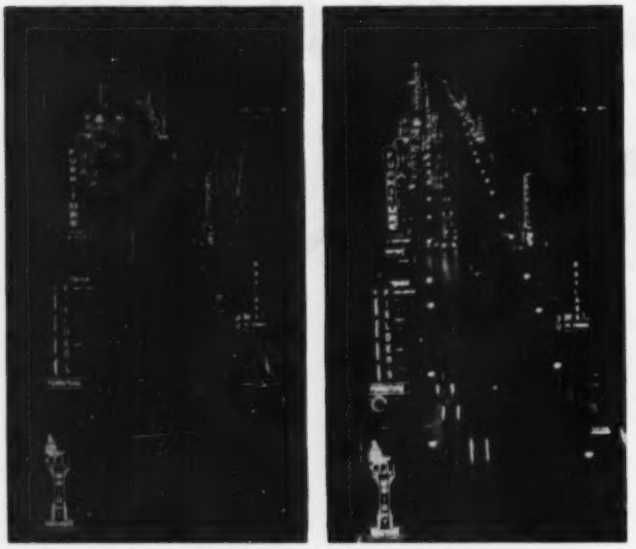
Fig. 1

Fig. 2

The schematic diagram above illustrates how the discharge of high velocity gases imparts recoil to a single vented fuse, Fig. 2. On heavy faults the rocket effect may be powerful enough to destroy the fuse or distort supporting hardware. The DOUBLE-VENTING principle illustrated in Fig. 1 eliminates recoil shock.

Southern States Equipment Corp.

HAMPTON **GEORGIA**



OBSOLETE AND INADEQUATE incandescent lighting (left) replaced by mercury system which increased intensity by 400% (right). Higher mounting height and wider distribution pattern vastly improved lighting on sidewalk and building fronts

Knoxville Lights Up

FRANK SEATON, Engineer, Knoxville Utilities Board, Knoxville, Tenn.

Mercury vapor lighting that provides 3.25 ft-c on the street surface was installed recently on ½ mi of Gay Street, Knoxvilles' principal business thorofare.

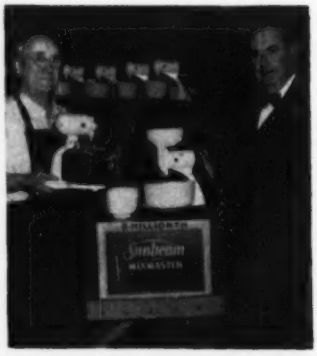
The mercury installation, first of its kind in Knoxville, immediately adjoins an incandescent lighting section at the northern end of the business district which was modernized in early 1951. This incandescent lighting extends some 1,500 feet through the remainder of the main business district, and consists of 500-w lamps spaced 100 ft opposite with an average mounting height above the street of approximately 30 ft.

The new lighting consists of 78 IES Type IV luminaires mounted 31 ft above the street on octaflute steel standards placed opposite and spaced at 80-ft intervals, which is the old trolley pole spacing. All lights are fed from the underground 120-v network secondary with ballasts mounted in the pole base. Lamps are 400-w, 15,000-lumen A-H1 mercury vapor lamp, burned horizontally by means of an arc centering magnet. The installation increases lighting about 400% over that provided by the old incandescent system.

Sales Course for Chicago Dealers

John W. Mock, Chicago business consultant, has been retained by the Electric Association of that city to conduct an eight-session course for appliance dealers and their key sales people on "Creative Selling in Chicago, 1952," Curtis L. Peterson, chairman of the Association's Dealer Educational Committee, announced recently. Peterson said that "this is a pick and shovel year, and the Electric Association recognizes that dealers have to go out and dig for sales." The course will consist of eight 1½ hour morning meetings. The first of these morning sessions will be held Wednesday, June 4.

"This isn't a general course on salesmanship," Peterson explained. "It is not intended to replace the product sales training of distributors and manufacturers. It is a tailor-made course designed to help dealers meet and beat the selling problems they face in Chicago's highly competitive market". The course is limited to 150 persons and the cost is $10 each, about one third of the actual, the Association underwriting the remainder.



What—That Many?

B. A. Graham, president, Sunbeam Corp, receives the 8-millionth Sunbeam Mixmaster as it rolls off the production line at the company plant at 5600 Roosevelt Road, Chicago. At left is John Burns, 1225 W. Lamon Ave, Chicago, holding one of the first Mixmasters manufactured in 1930. Burns has been a Sunbeam employee for 45 years.

PENNSYLVANIA POWER & LIGHT COMPANY
A BUSINESS-MANAGED TAX-PAYING COMPANY
MANNED BY 6700 FRIENDLY HOME-TOWN PEOPLE
AND OWNED BY 75,000 INVESTORS,
MOST OF THEM YOUR NEIGHBORS AND FELLOW PENNSYLVANIANS

Neat—Succinct—Effective

Helping to get the message of business enterprise over to the people of eastern Pennsylvania is this signature logotype now in use on newspaper advertisements of the Pennsylvania Power & Light Co.

VICTOR DISTRIBUTION INSULATORS

NOW EVEN BETTER WITH PURIFIED PORCELAIN!

NO. 504
GUY STRAIN

NO. 5 LOW-VOLTAGE
PINTYPE

Spools, guy strains, pintypes, suspensions—all are made of the same new *PURIFIED* PORCELAIN as VICTOR's high voltage transmission types. This means that every VICTOR insulator is a better insulator—with highest insulation values, unequalled density, rock-like strength, hardness and resistance to impact, and a product uniformity never before achieved!

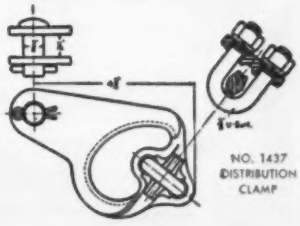
Through years of research, VICTOR has eliminated the last big variable in porcelain-making by removing all mineral salts from water used in processing. Results are reduced fluctuations in shrinkage and density and virtual elimination of microscopic, glass-like impurities which, up to now, have prevented maximum insulator strength and hardness. Remember—VICTOR *PURIFIED* PORCELAIN is the finest insulator porcelain ever made!

NO. 2012 SPOOL

NO. 804 SUSPENSION

VICTOR INSULATORS, INC.
VICTOR, N. Y.

Specify
VICTOR
INSULATORS



NO. 1437
DISTRIBUTION
CLAMP

DISTRIBUTION LINE HARDWARE

VICTOR carries a complete line of distribution clamps in all required types and materials to accommodate cable sizes from 0.145 to 0.60 inches. Snubbing, quadrant or boltless types in forged steel, malleable iron or pressed steel with or without aluminum liners, according to type and size of cable to be accommodated.

GLARE-FREE HIGHWAY INTERSECTION is lighted by new fluorescent luminaire which concentrates light on crossing pavement, does not create any bright streaks on wet roadway. Each unit produces 23,200 lumen, slightly more than one 20,000 lumen mercury vapor lamp

Glare-Free Lighting for Intersections

A new lighting unit specifically intended for highway intersection illumination has been designed by the Traffic Control Section of the California Division of Highways Traffic Department. More efficient than conventional-type street lights, this luminaire directs the main portion of its light into the intersection. It produces a bright area on the pavement which enables the approaching driver to see objects at the intersection both by direct illumination and by silhouette. This wide brightness pattern is not affected by a wet pavement surface so that there are no excessively shiny streaks on the road on rainy nights.

F. M. CARTER, California Division of Highways, Sacramento, Calif.

The unit is approximately 16 ft long, is composed of four 8-ft slimline fluorescent lamps in tandem pairs. Instant starting, each lamp produces a light output of 5,800 lumens at an operating current of 600 milliamperes, giving a total of 23,200 lumens per unit. A paraseil-shape (parabolic and spherical sections joined together) reflector with white porcelain enamelled facets reflects the light rays onto the intersection pavement. A 20-ft, 3-in. horizontal mast arm, mounted on the far right-hand corner of the intersection, supports the unit at right angles to the travelled way at 28 ft above the road.

At rural intersections where there are no surrounding sources of light, the ordinary street lighting unit can be very glaring against the night sky. The new unit is particularly effective at such locations.

Mitchell Mfg Co

Better Light for Banking

A complete lighting renovation in the Brookline Savings and Trust Co, Pittsburgh, Pa., has resulted in an increase of light by over 400 per cent. Before the installation of 40 ceiling-mounted "Module" units the light intensity in the banking room was only 15 ft-c. Intensity is now 85 ft-c. Although the ceiling is 22 ft high, the units provide glare-free illumination throughout.

Home Laundry Instruction

Techniques and helpful hints for laundering today's washables are explained and simplified in a new 40-page, seven-chapter booklet announced recently by the Westinghouse Home Economics Institute. Complete information is given on how to launder specific fibers including the newer man-made fibers—orlon, dacron, dynel and glass fiber. Principle types of washers, clothes dryers, hand irons and electric ironers are discussed and pointers are given for their care and use. Copies of "Home Laundering" (booklet 1CE-0203) are available at five cents each from Consumer Service, Westinghouse Electric Corp, Manfield, Ohio.

Electric Valet

"Place the garments on hangers in the steel cabinet, add a little water with a special chemical in solution, close the doors and connect to the electric current." That's how to operate a recently announced electrical device that is claimed to free clothes from wrinkles, make creases in trousers look like newly pressed and restore the cloth to original firmness. It is called the "Au-Tomic Valet" and is a product of J. P. Burger & Associates, 1813 Columbus Road, Cleveland 13, Ohio.

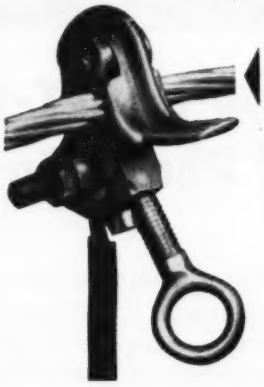
CHANCE

Hot Line Clamps

meet all your tap clamp requirements

Chance Hot Line Clamps are the standard of many companies for all applications. They are moderately priced, yet have quality features that mean better line connections . . . high current capacity . . . high mechanical strength . . . and longer conductor life.

Whatever your requirement—when you specify CHANCE—you can make your selection from *the most complete* line in the industry. Chance Hot Line Clamps are designed on the basis of extensive research and years of connector know-how – they're built by the leaders in the development of hot line clamps.



FLIP-TAP CLAMPS

The Chance Flip-Tap Clamp features a grease chamber, filled with a corrosion resisting compound which prevents the clamp from sticking on the conductor. This clamp is easily guided to the line and is tightened by turning the eye-screw. Jaws of the clamp will take conductors ranging in size from No. 8 solid copper to 4/0 stranded copper or 3/0 ACSR.

PROTECTED CONNECTION CLAMPS

These new Chance hot tap clamps will not "freeze" on the line . . . will not heat excessively . . . will not damage or overstress your conductor . . . and will positively maintain contact throughout the life of the installation. They are available for aluminum or copper connections in sizes to meet every requirement.

PERMA-GRIP CLAMPS

Make permanent or temporary hot tap connections that hold tight without sticking and stay put without vibrating loose. USS threads screw up fast, hold tight . . . yet can be readily unscrewed with a clamp stick. They are available for all types of connections in a complete range of sizes to meet every requirement.

CHANCE ELECTRICAL CONNECTORS

U-BOLT CONNECTORS

These connectors apply to conductors without removing bolts—the swinging center spacer and base eliminate the necessity of removing nuts and lock washers when applying to conductors. No annoyance of losing nuts or washers—application is quicker and easier. Chance U-Bolt Connectors simplify your inventory problems —only *three* sizes are needed. Available for aluminum or copper conductors.

PARALLEL GROOVE CONNECTORS

Inexpensive, easily installed, lightweight connectors for use on line construction. All connector bodies plus galvanized bolts, nuts and lock washers are corrosion resistant. Available in a complete range of types and sizes. Heat treated aluminum, galvanized contact copper, or all copper.

For better hot tapping . . . for permanent connections . . . choose CHANCE. The line is complete, and offers the most advanced designs on the market. You know it's RIGHT when you specify CHANCE.

ABC INDUSTRIES

A·B·CHANCE CO·

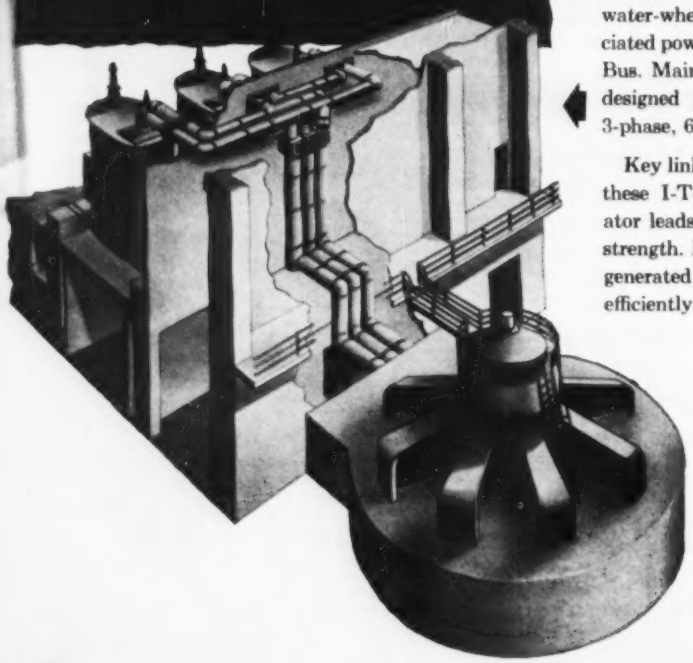
CENTRALIA, MISSOURI

SAN FRANCISCO, CALIFORNIA

C52-7

All power generated at Grand Coulee

is carried by I-T-E Isolated Phase Bus



EIGHTEEN SETS OF GENERATOR LEADS

All eighteen of Grand Coulee's giant 108,000-kw water-wheel generators are connected to their associated power transformers by I-T-E Isolated Phase Bus. Main buses are rated at 5,000 amperes and designed for an operating voltage of 13.8-kv, 3-phase, 60-cycle—with one conductor per phase.

Key links in this huge power-generation system, these I-T-E air-insulated, metal-enclosed generator leads possess high dielectric and mechanical strength. Bus is built to carry the heavy currents generated by these eighteen power giants, safely—efficiently—dependably.

SIX PUMP BUS RUNS

The Grand Coulee pumping station will ultimately house 12 giant pumping units, each powered by a 65,000-hp, 200-rpm, 13.6-kv, 3-phase, 60-cycle synchronous motor. *Six pumps are now in service. Six others are planned for future installation.*

Power for this pumping service is supplied by three of the main generators, each generator feeding *two* pump motors. The three I-T-E Isolated Phase Bus runs now installed carry power—4300 amperes in each circuit—260 feet up the face of the dam. Six branch buses, rated at 2150 amperes each, connect the pump motors.

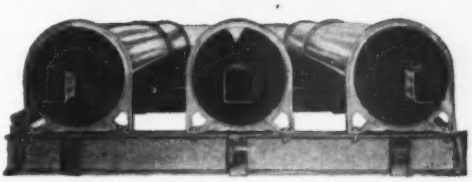
This I-T-E bus connection—comprising *9000* single-phase feet—is the longest structure of its kind in the world.

DESIGNED FOR MAXIMUM SERVICE CONTINUITY

Principal feature of these I-T-E bus runs is unique *isolated phase* construction. Each conductor is encased in an *individual* non-magnetic housing. Each housing is separated from adjacent housings by an insulating air space. *Phase-to-phase short circuits are virtually eliminated!*

MORE THAN 30 CONDUCTOR-MILES IN 277 INSTALLATIONS

I-T-E Isolated Phase Bus has been transmitting power from the world's largest generators since 1936—providing power plants with safe, dependable service.



I-T-E

ISOLATED PHASE BUS

I-T-E CIRCUIT BREAKER CO. · 19th AND HAMILTON STS., PHILA. 30, PA.

CANADIAN MFG. AND SALES: EASTERN POWER DEVICES, LTD., TORONTO · EXPORT SALES: PHILIPS EXPORT CORP., N.Y., N.Y.

NEW EQUIPMENT

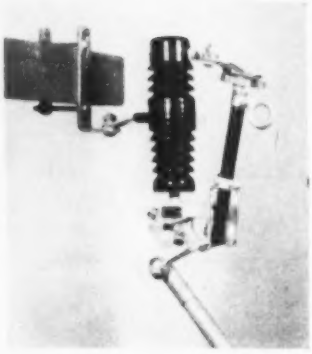
Mini-Breaker

The Mini-Breaker is a new protective device that offers circuit breaker protection with ordinary home panelboards. The device can be installed in any standard Edison base plug-type fuse receptacle rated at 110 to 125 v ac.

The Mini-Breaker requires no rewiring or additional equipment when applied to circuits of corresponding 15, 20-, or 30-amp ratings. It reportedly can be installed in a matter of seconds, and anyone can restore service to a circuit by simply pushing in the protruding reset plunger.

The outward appearance of the breaker is such that it resembles the fuse it is designed to replace. The Mini-Breaker is actually a thermal circuit breaker. In operation it is stated to safely interrupt excessive overloads and short circuits, tripping instantly on shorts, but with built in time lag for handling temporary starting loads and line surges. While service can be restored normally by pressing in and releasing the reset plunger, the device is trip free and will continue to interrupt the circuit until overload conditions are corrected. It cannot be held in the closed position on an overload.

Mechanical Products, Inc, Jackson, Mich.



Load-Break Device

A new load break device for 100-amp open-dropout cutouts has been developed. This new device, a lever attached to the cutout fuseholder, reportedly enables linemen to open circuits under load safely. Sectionalizing and capacitor bank switching are also uses for it.

The load-break device is available on 100-amp, 7.8-kv (either 2,000 or 5,000 amp interrupting capacity) and 15-kv open-dropout cutouts. Cutouts already in service can be easily changed to load-break operation by replacing the old fuseholder.

It is claimed the load-break feature adds little to the cost of the conventional cutout, takes up no extra pole space and involves no additional expense. Device permits mechanical tension and resulting mechanical breakage at the fusible element of the fuse link.

Manual operation is accomplished with a switchstick. Load current interruption occurs within the fuseholder in a manner similar to cutout operation when low-fault current conditions occur on a feeder.

General Electric Co, Schenectady 5, N. Y.

New Insulating Paper

A new insulating paper has been developed by the **Naval Research Laboratory.** This quartz paper is superior to asbestos as an electrical insulation, and can be made cheaply and plentifully from domestic sources.

The lab-produced fibers are chemically identical to asbestos and can be made into paper the same as ordinary paper. The paper will withstand temperatures up to 3000F as against 1000F for asbestos.

Boron free, it will not become radioactive and may have a great future in the atomic age. Navy scientists are interested in this property for nuclear energy power plants.

Other valuable potentials are that it has a low dielectric constant, and it appears it can be used in radar antenna housings in the immediate future.

Steel Framing Material

A new steel framing material called Mult-A-Frame has been developed recently. Consisting of three basic units, equipment can be built with it for present needs and at the same time it reportedly can be dismantled, adapted or converted without scrapping to meet new and different uses.

The three basic units are a channel frame, spring-T-bolt and safe-locking fittings. The company reports hundreds of special fittings are available for any number of different types of building that might be desired.

Applications are for racks to hold conduit, wire, cable reels, etc. It can also support conduit runs, switch panels, fluorescent fixtures, etc.

Ainsworth Mfg Co, Detroit, Mich.

LET'S TALK WIREHOLDERS . . .

HUBBARD 4-11-44 *has what it takes*

No other wireholder combines so many desirable features as the famous HUBBARD 4-11-44 . . . advantages which have been proven in millions of installations.

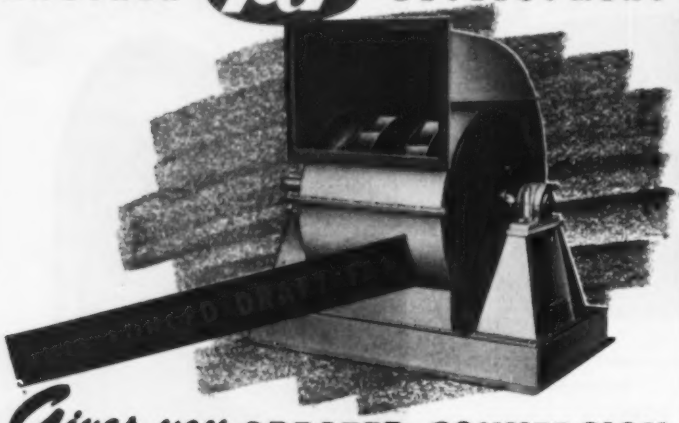
HERE'S THE LIST....

1. Designed so that the heavy Copperweld bail takes all the tension . . . the porcelain is subjected to compression only.
2. The smoothly rounded surfaces avoid damage to insulation.
3. The special wood screw is sharp-pointed, easy to start by hand; the threads are sharp, deep, clean-cut, for fast insertion. No other wireholder screw on the market can match the Hubbard design for ease of installation or holding power.
4. The thread is cut clear to the base, and gives a strong grip, even in material considerably thinner than the length of the screw.
5. The heavy steel base is Hubbard double-dip hot galvanized, to effectively prevent corrosion or rust streaks; the 4-11-44 is built to resist the elements through the years. There are no closed pockets to retain moisture and dirt that cause unsightly streaks.

Exhaustive tests have proved that the Hubbard 4-11-44 has the greatest dead-end strength of any wireholder manufactured, plus sufficient strength on angular attachments to provide proper margins of safety over any load which would be encountered consistent with approved engineering practice.

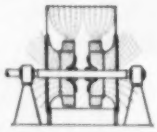
HUBBARD AND COMPANY
ESTABLISHED 1843
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA
"Hang the Load on Hubbard Hardware!"

ANOTHER pd DEVELOPMENT

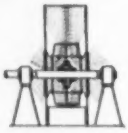


Gives you GREATER CONVERSION

OF VELOCITY PRESSURE TO STATIC PRESSURE



How P-D split wheel assists diffusion—aids distribution throughout the fan.



Conventional double wheel with common disc produces concentration, results in poor diffusion.

Performance ratings of the Prat-Daniel F-D Fan are established according to the Standard Test Codes adopted by N.A.F.M. and the A.S.H.V.E.

Design characteristics provide unusually high conversion of Velocity Pressure to Static Pressure. This is accomplished by streamlined inlet cones that are larger in proportion to the wheel than are usually found in forced draft fans. The unusual depth of the cones provide a wider housing than would customarily be used, increasing the space available for diffusion. Precisely fashioned backward curved blades provide a nearly perfect aerodynamic flow across both leading and trailing edges. Double wheel fans are spaced apart to permit four way diffusion of air, further contributing to this conversion. Peak efficiency and horsepower curves fall well within normal fan selection range, offering the optimum in maximum efficiency and non-overloading characteristics.

These are all carefully researched features that have made the Prat-Daniel F-D Fan a highly efficient apparatus. Check these features before you decide on your next fan. Write for catalog No. 300 today.

UNIT RESPONSIBILITY

The Thermix Corp., project engineers for the Prat-Daniel Corp., offer all components required for the handling of air and gas: (1) P-D Forced Draft Fans; (2) P-D Air Pre-Heaters; (3) P-D Tubular Dust Collectors; (4) P-D Induced Draft Fans; and (5) P-D Fan Stacks. This unit responsibility, by a well known firm, relieves the engineer of the necessity of integrating equipment from various sources into the over-all project.

Sales and Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.
1440 St. Catherine St. W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

Potential Transformers

An improved line of outdoor and indoor potential transformers in the 2.4-kv class has been announced recently. The PTs are insulated with a crepe paper insulation that is vacuum dried and impregnated and has a high impulse and dielectric strength, and a low insulation pf.

Units are available in either 45- or 60-kv full wave impulse test level. The new transformers meet the 0.3W, 0.3X, 0.3Y and 1.2Z metering accuracy classifications. The transformer is mounted in a single-piece deep-drawn steel case with a welded-on base. It utilizes a no-leak filling plug and new HV bushings mounted without bushing flanges.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Correction Please!

In describing the simplified coil supports of the General Electric Co's new lighter-weight distribution transformer (Electrical World, May 5, page 138) it was stated that the coil supports "reduce short circuit strength materially." The sentence obviously should have read "have increased short circuit strength materially."

Cable Cutter

Distinctive feature of this new cable cutter is the heart-shaped design of the opening between jaws. This is said to result in clean, true cuts, free from ragged ridges across the center of the cable. There is no deformation of the cable, even in extra flexible constructions, and the individual strands are free from burrs.

The new cutter, designated No. 365,

is equally well adapted to bare or insulated copper or aluminum cables up to 500 Mcm. It will take outside insulation diameters up to 1½-in.

This tool provides a mechanical advantage of 18 to 1. Stops on the handle maintain a minimum opening of 3-in. to prevent barking of knuckles.

The Thomas & Betts Co, Inc, 14 Butler St, Elizabeth, N. J.

Metal Nameplate

A new type metal nameplate with an adhesive backing, called Necal adhesive, has been announced recently. This enables the nameplate to be applied to many types of surfaces.

Feature is the ease of application. To apply them, they must first be immersed in water for about 1-minute. They are then pressed into position.

Nameplates are available in all colors and finish combinations in gauges as low as .005 for lithographed plates and .012 for etched plates.

Northern Engraving & Mfg Co, La Crosse, Wisc.

Circuit Analyzer and Tester

Two new instruments, the Model 102 Circuit Tester and Model 247 Power Circuit Analyzer (illustrated) have been introduced recently. Both are claimed to be accurate, compact in design and light in weight.

The circuit tester is stated to be ideal for testing signal and alarm circuits, servicing industrial electronic and communications systems, testing motors and lighting loads and maintenance of power systems.

The power circuit analyzer is said to be invaluable in locating unbalanced loads; overloaded, underloaded

Are you thinking about a MICROWAVE communications system?

This handy 5-point check-list will help you get the right equipment for *your* particular needs.

1. How long a system do you need?

Whether it's 20, 200 or 2000 miles long, RCA has the *right* equipment for your job.

- RCA "short-haul" microwave covers the shorter distances up to 200 miles.
- RCA "long-haul" microwave covers the longer distances up to 2000 miles.

So whatever *your* needs, you get the *right* system from RCA.

2. How many channels do you need?

One of RCA microwave's biggest bonus features is *tremendous channel capacity.*

- RCA "short-haul" system provides up to six voice channels including service channel depending upon number of hops. Voice channel can be split into 8 to 16 control channels.
- RCA "long-haul" system provides 24 voice channels plus service channel. Again, any voice channel can be split into 8 to 16 teletype or control channels.

Thus far, no RCA microwave user has ever run out of channels. It seems there's "always room for one more"!

3. What about installation?

RCA will work with you any way you desire.

- If you want equipment only—RCA will supply it.
- If you want installation supervision—RCA Service Company engineers are available.
- Or, RCA Service Company engineers will arrange for the complete installation.

Again, you get just what you want when you specify *RCA* microwave.

4. How about reliability?

Again—what do you need? Can you stand an outage of several hours? Or is uninterrupted service of vital importance? Either way, RCA fits the system to your needs:

- First—by making it *extra* dependable to start with.
- Second—by providing partial standby equipment at inaccessible stations, as needed.
- Third—by providing full standby equipment all along the line, if needed.
- Fourth—by providing emergency 24-hour service on tubes and parts, if desired.

You *get* what you *need* with RCA.

5. How about maintenance?

Again, the RCA Service Company will do any or all of it, as desired. And *only RCA has this nation-wide organization of trained engineers* ready to render this service.

If you want microwave, why take less than RCA?

Why accept less than that provided by the world leader in radio and electronics? RCA has more know-how in high-frequency radio than any other company on earth. And you reap the benefit of this experience when you specify *RCA microwave . . . built and backed by the men who really know radio.*

You get these 7 plus features with RCA Microwave

1. Uses conventional tubes throughout.
2. Easy to tune. Has built-in metering.
3. Handles large number of single sideband frequency division channels without excessive cross-talk.
4. Flexible. Any or all voice or control channels can be picked up or dropped at any station, repeater or terminal.
5. Service channel with signaling available at each repeater and terminal station.
6. Vertical rack design saves floor space, provides ready access both front and rear.
7. Designed, built, and backed up by RCA . . . world leader in radio and electronics.

More information? Mail Coupon TODAY

RCA Communications, Dept. 45-F,
Camden, New Jersey

Please send me information on RCA Microwave for the application indicated below:

Name_____

Position_____

Company_____

Address_____

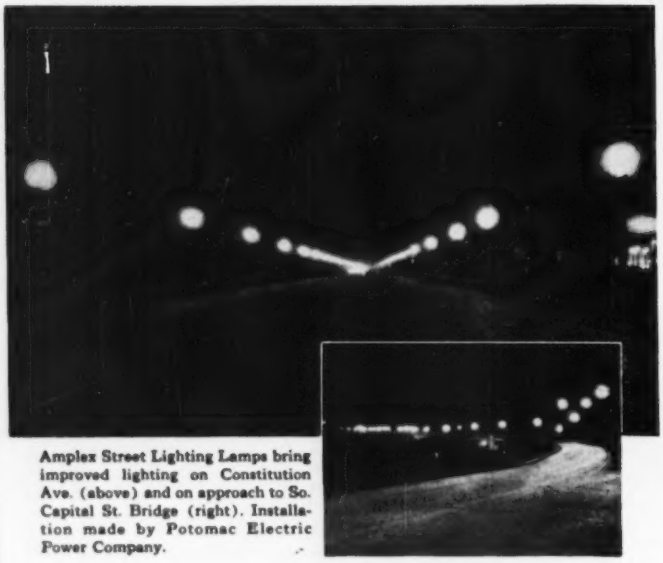
City_____ State_____

☐ Please have an RCA Microwave Engineer call on me.

RCA **RADIO CORPORATION of AMERICA**

Better light in the nation's capital!

AMPLEX
STREET LIGHTING LAMPS



Amplex Street Lighting Lamps bring improved lighting on Constitution Ave. (above) and on approach to So. Capital St. Bridge (right). Installation made by Potomac Electric Power Company.

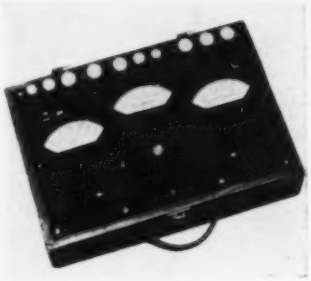
FROM ONE COAST TO THE OTHER, Amplex Street Lighting Lamps are the fastest-growing choice of cities and utilities. Experience shows that these lamps give outstandingly superior service . . . and so they should! They're designed and premium-built to withstand the vibration and jolts of fast-moving traffic . . . to burn longer and to maintain their high light output.

In the Amplex line there's a street lighting lamp of the right type and wattage for every purpose. And for truly maximum life and dependability there's nothing equal to Amplex *Weatherproof Bulbs*. They're made of moisture-resistant "hard glass" that survives the severest climatic conditions and cuts service costs to new lows.

It will pay you to get all the facts about Amplex Street Lighting Lamps. Just write **Amplex Corporation, Dept. J-6 111 Water St., Brooklyn 1, N. Y.**

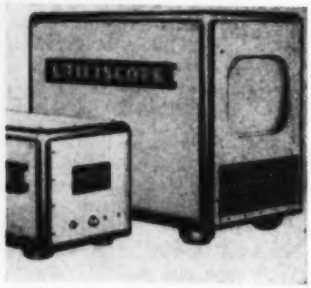
AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.



or defective motors, low power factor and excessive circuit voltage drop. It can be used on single, two, or three phase systems. Unit has shielded meters and an adjustable follow-up pointer.

Instrument Laboratories, 315 W. Walton St, Chicago 11, Ill.



Wired Television

A new Utiliscope, Model 300-B, has been developed recently. This complete installation consists of a camera, a small power unit and the monitor or viewing unit.

The monitor unit contains a cathode ray tube with its associated circuits and a built-in power unit.

Features of this new model are improved appearance and greater serviceability. Servicing, when needed, is reported to be greatly simplified by the new construction. Any side of each case can be separately removed for easy inspection and servicing.

Diamond Power Specialty Corp, Lancaster, Ohio

Circuit Breaker Panelboard

The PB Electri-Center has been recently introduced as a general purpose circuit breaker panelboard for controlling lighting and appliance cir-

cuits. The panelboard is rated for 3 wire, single phase, 120/208 v ac with 100-amp main wire grips or for 4 wire, 3 phase, 120/208 v ac with 100-amp main wire grips.

The PB panelboards are available in two sizes, 14 or 20 circuits. The panels employ the Pushmatic Circuit Breaker which requires a push of the button to operate.

Bulldog Electric Products Co, Detroit 32, Mich.

Dead End Clamp

This new dead end clamp is designed to accommodate a wide range of wire sizes from No. 6 ACSR minimum to No. 1/0 ACSR maximum. These clamps can be used for either dead ending or for tapping.

All wire sizes are held securely in place in the clamp. The flanges on the sides of the spacer bar completely enclose even the large cable sizes so there is no possibility of the strands spreading apart when the clamp is tightened.

The cap and tightening plate are cast of high strength, heat treated aluminum alloy. The spacer bar is an aluminum alloy with high conductivity and it firmly grips the wire under pressure.

J. A. Weaver Co, 2110 Howard St, St. Louis, Mo.

Flame-Retardant Plastic

New flame-retardant laminated plastics provide increased safety by use of a new resin formulation. The incorporation of the flame-retardant feature has no detrimental effect on punching or machining properties.

This retardant extinguishes flame

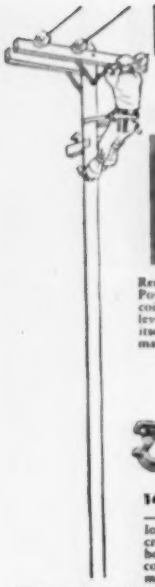
● There's no doubt about it . . . Koppers Poles do bear up. Decade after decade, they *retain* their strength.

By giving such long service, Koppers Pressure-Creosoted Poles cut replacement costs. By giving such trouble-free service, they make line operation easier and more economical.

For service that *more* than meets your requirements, specify Koppers Full-Length Pressure-Creosoted Poles.

KOPPERS COMPANY, INC. PITTSBURGH 19, PA.

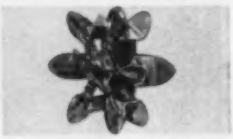
KOPPERS PRESSURE-CREOSOTED WOOD



DESIGNED TO MEET YOUR NEEDS...in Line Construction and Maintenance

COLLAPSIBLE REEL

Saves Time • Man-Hours • Material



Reel up wire — quickly and neatly — with the Eagle Type CR Collapsible Power Reel. Attaches to winch shaft with bayonet-type socket. Easy removal of coiled wire by collapsing holding arms of reel by a quarter turn of a convenient lever; a few turns of lever again expands reel. A useful accessory that pays for itself in materials and man-hours saved. Weighing only 75 lbs., the reel is made of aluminum alloy and steel, combining strength with light weight.

1417 PINTLE HOOK

— designed for heavy duty. Positive lock type latch. Easy to install on rear cross member of truck with only 7 bolts. Weight 48 lbs. Furnished with complete braces, bolts, and nuts for mounting.

HEAVY DUTY DRAWBAR "H"

For use with 3 and 5 ton pole trailers. Has coupling eyes to fit standard pintle or towing hooks. Length 50 inches; width 3 inches. Tighteners 8 inches apart. Weight 55 lbs.

EAGLE

EAGLE MANUFACTURING CO.
Division of
The Four Wheel Drive Auto Co.
APPLETON, WISCONSIN

Utility Bodies • Trailers • Pole Derricks
Tools and Accessories
Eagle equipment is engineered by and for utility men expressly for their needs

Send today for the complete catalog of Eagle Line Construction and Maintenance Equipment — a useful reference book.

count these *extras* in...

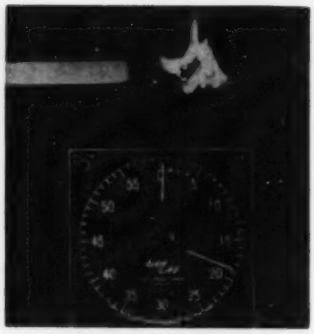
WEAVER

ground rod clamps

- Cast of high strength electro-bronze specially alloyed in our own electric furnaces.
- Heavy duty Duronze screws furnished with square head or socket type with wrenches at no difference in cost.
- Clamps provide for perfect alignment of rod and ground wire in high pressure contact.
- Clamps fitted with special round pointed screws so that surface of ground rod is not damaged on tightening the screw.
- Weaver Ground Rod Clamps are priced very competitively.

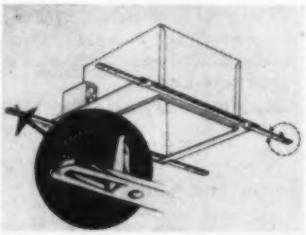
J. A. WEAVER CO.

2110 HOWARD ST. • ST. LOUIS 6, MO. • CEntral 0881



much faster than untreated plastic. It is expected to find application in electrical circuit breakers and aircraft equipment where the absence of afterglow may be important.

Synthane Corp, Oaks, Pa.



Mounting Strap

The Redi-Set mounting strap is reported to make it easier for one man to install recessed lights. After inserting the straps the workman simply taps each prong a few times and the housing is firmly fixed. Then the workman has both hands free to drive the additional screws or nails, as required.

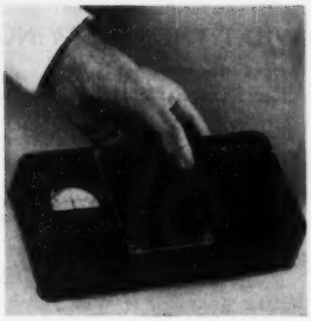
These mounting straps are said to eliminate framing-in and allow the housing to be positioned exactly, either before or after the straps are attached to the ceiling joists.

Pryne and Co, Pomona, Calif.

Measuring Bridge

The Type Z measuring bridge has been recently designed to take the place of a large wheatstone bridge for measuring resistances in the field, workshop or laboratory.

The range of this bridge is 0.5 to 50,000 ohms over six ratios. Simple to operate, this bridge is said to be always ready for use as a standard flash-



light battery is contained in the case. Sensitivity is about plus or minus 1%.

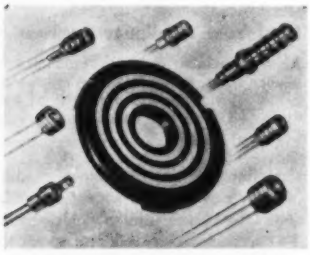
Herman H. Sticht Co, 27 Park Place, New York, N. Y.

Wood Pole Protector

Reportedly, this is the answer to an economical method of protecting all types of wood uprights from fire. Called Fireplate, it is believed to be the first practicable fire-retardant coating of a bituminous nature, which under extreme heat stays put on vertical wood surfaces and releases fire-smothering gases.

The incombustible solvent in Fireplate provides fire protection as soon as it is applied. It also is said to help guard surfaces against destructive weathering.

The Zone Co, Fort Worth, Tex.



Slip Rings and Commutators

This new method of producing slip rings and commutators uses the electro-deposition method. This provides dimensional precision, accurate concentricity and high dielectric qualities.

Higher quality and lower costs are said to be features of these new products.

Instrument Corp of America, Blackburg, Va.

Smoke got t… their Eyes

. . . but BEFORE the Fire!

Yes, the Men in Authority couldn't see the need—the *vital* need—for the *right* kind of fire protection. And fire struck, as always, when least expected—devastating fire that destroyed irreplaceable records, costly machines, buildings and supplies which will take months—months of no production—to rebuild and replace.

Statistics prove that too many fires result from failure to be ready for them—particularly in generators, transformers, switching and other electrical equipment.

Are *your* operations safe? A survey by Cardox will show you how CARDOX "Low Pressure Carbon Dioxide Systems"* can protect the danger spots in your plants against fire—eliminate fire extinguishment losses entirely. A few lines on your letterhead will bring full, eye-opening information.

*Covered by Patents Issued and Pending

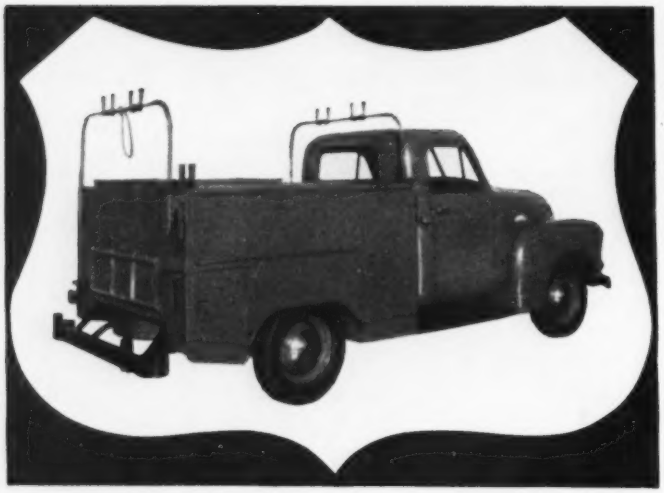
CARDOX

ORIGINATOR OF Low Pressure CO_2

FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION • BELL BUILDING • CHICAGO 1, ILLINOIS

Offices in Principal Cities



it's new...HIGHWAY GS-75
GENERAL SERVICE BODY
STURDY • FLEXIBLE • ALL-PURPOSE

At last! Here is a basic, general service body to which you can add your own selection from a wide variety of options to actually "build" a unit to meet your specific needs. At the same time you control the cost to fit your purse. With the Highway GS-75 you are not required to take a manufacturer's "pet ideas" as a permanent part of your body.

This sturdy all-steel body is equipped with heavy, double-panel doors opening on spacious side-box compartments. Two different side-box shelf arrangements are available as options. Locking-type, recessed handles on the doors control strong one key bar-locks. The doors are weather-sealed with sponge rubber, retained by metal strips. A popular option is the steel roof that slides forward, folds down and locks to the tailgate, protecting any materials stored in the big interior bed compartment.

Sidebox Arrangement "A"

Sidebox Arrangement "B"

Body is 75" length, 74" width. Mounts on most ½ ton chassis, "CA" dimensions 39" to 41".

Send today for full information on this new Highway GS-75 body and other Highway public utility equipment. Or, call or visit the friendly Highway Distributor or Factory Branch nearest you.

HIGHWAY TRAILER COMPANY

Headquarters: Edgerton, Wisconsin

PLANTS AT EDGERTON, WISCONSIN—STOUGHTON, WISCONSIN

The nation's largest Manufacturers of Utility Truck Bodies • Earth Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories

WHAT THEY'RE SAYING

At Industry Meetings

Economics and Con Edison

Hudson R. Searing, President, Consolidated Edison Co of New York, before The Cooper Union for the Advancement of Science and Art at New York City, N. Y.

Competent studies have shown that if taxes equivalent to those paid by private utilities were added to the operating costs of government projects, the rates they would be required to charge for electricity would be higher than those in effect in private utilities. Keep this fact in mind when you hear that the State or Federal government can produce and sell electricity more cheaply than a private concern.

Beware of the "something for nothing" philosophy of government operation. Services received from the government must be paid for by the people. The essential difference between private utility production and the government is that the former receives its investment money from private sources and pays a large share of its income in taxes, while government projects receive their funds from public grants, which is a nice way of saying taxes, and pay no taxes to maintain the general welfare.

Hold Your Appliance Business

A. W. Bernsohn, director, National Appliance and Radio-TV Dealers Assoc, before Annual Spring Conference of the Rocky Mt Electrical League at Denver, Colo.

Nothing in the experience of our industry can compare with television's ability to inspire sales people in new TV territories to sell, turnover to accelerate, or total gross profits to increase. It has every element necessary for glamorous merchandising and it will be a chance to attain growth never before experienced.

There are however literally thousands of dealers in older television areas whose experience will confirm the advisability of sticking to the business that is now your livelihood and expanding into television. Hold a careful balance of television and appliance inventory by projecting your white goods and traffic appliance sales

figures reasonably far ahead, using figures based on your present operation. Hold your appliance lines and make television "in addition" rather than "instead" business because eventually you will find that you are operating in an old television area.

Control System's New Partner

R. L. Scafford, Cornell Aeronautical Laboratory Inc, before North Eastern District Meeting of the AIEE at Binghamton, N. Y.

The development of electronic control system's "new partner," a high speed linear hydraulic valve, capable of being driven by a pair of miniature triodes, has opened a new field for automatic control in those applications requiring high speed operation at large power levels.

Electrohydraulic systems have certain advantages over pure electromechanical systems but the former heretofore have been limited in application because of the awkwardness of control systems. However, developments in the technique of controlling hydraulic flow electrically now permit the flexibility of electronic control to be applied to the linear operation of hydraulic valves at high speeds.

Minimum-time hydraulic systems have many applications in guided missiles, where high power output to operate control surfaces is required for short periods of flight.

Southern Industrial Expansion and Training

W. F. PATTERSON, director, bureau of apprenticeship, U. S. Dept of Labor before the Second Annual Apprenticeship Completion ceremony at Savannah, Ga.

In 1951, 36,600 apprentices throughout the U. S. were awarded certificates of completion, 3,875 of whom were in southern states and approximately 500 in Georgia. This indicates the returns now being received by the National Apprenticeship Program. It also reflects the growth of industrial activity in southern states at present.

The defense production program is constantly in need of thoroughly trained craftsmen thereby making apprentice training a never ending responsibility. Training for high level skills and knowledge as well as education is essential to the nation's long range interests.

KNOX

has THE ANSWERS TO YOUR INSULATOR PROBLEMS AS LEADERS IN

- QUALITY
- SALES
- SERVICE

Quality made by specially trained Ceramic Engineers . . . rigidly inspected at every point of their manufacture—not just to pass laboratory tests and meet specifications while they are new, BUT to deliver trouble free, customer pleasing service year after year — THAT'S KNOX INSULATORS.

Yes, KNOX High Voltage Insulators are quality-made to give the kind of service that means satisfaction and sales. They're made tough and strong and right to cut maintenance and replacement costs to the bone. They excel where leadership really counts. And they're proving it under severe conditions everywhere.

Take advantage of it today. Sell KNOX Insulators. Buyers have confidence in KNOX products—they buy KNOX.

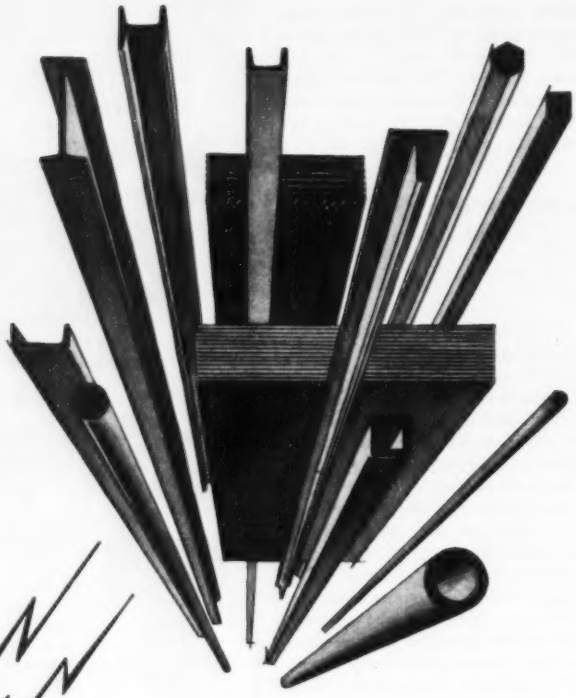
OUR AMPLE STOCKS INSURE PROMPT SHIPMENT. SEND US YOUR ORDERS TODAY!

- SUSPENSION INSULATORS
- GUY STRAINS
- TRANSMISSION PINTYPES
- DISTRIBUTION PINTYPES
- MEDIUM VOLTAGE PINTYPES
- SPOOLS
- SECONDARY RACKS
- SERVICE RACKS
- CLEVISES
- WIREHOLDERS
- SPECIALTIES

KNOX PORCELAIN CORPORATION

KNOXVILLE 1, TENNESSEE

STEEL for UTILITIES



In stock...Prompt shipment

When you call Ryerson for steel, you can be sure of prompt, personal service from the minute your call comes in. With the exception of those few items remaining in short supply, we can fill all your orders quickly from stock on hand. And to assist you on any problem of steel procurement, application or fabrication, the friendly counsel of experienced Ryerson specialists is always yours for the asking.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled & cold finished
STRUCTURALS—Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot & cold rolled, many types & coatings
TUBING—Seamless & welded, mechanical & boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars & Accessories, spirals, wire mesh
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

CALL RYERSON

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SEATTLE • SPOKANE

Cooper Named a Vice President

Minnesota P&L elevates president's assistant to executive post. He brings wide experience to position

Howard W. Cooper, who joined Minnesota Power & Light Co as assistant to the president in 1940, has been elected a vice president. His new title will be vice president and assistant to the president.

Cooper entered the utility field in 1919, shortly after his discharge from the Army. A graduate of Oregon State Agricultural College in electrical engineering, he was first located at Yakima, Wash., with Pacific Power & Light Co. Later he became district manager and was located at several district headquarter points in Washington before being transferred by the company to Lewiston, Idaho. When this property was purchased by Washington Water Power Co he became division manager.

In 1933 he went to Madison, Wis., as vice president of Wisconsin Power & Light Co, remaining there until 1937 when he became operating vice president of Central Power & Light Co which is located at Corpus Christi, Tex.

H. W. COOPER

WWP Announces Changes

Washington Water Power Co has announced promotions and transfers for nine operators and station superintendents in order to provide a crew for the Cabinet Gorge plant now being constructed.

Roy Ferguson, station superintendent at Chelan, Wash., will be superintendent of the Cabinet Gorge installation. John Graham, operator of B station at Nine Mile, will be chief operator at Cabinet Gorge.

T. Vern Fryer, superintendent of Monroe Street, Nine Mile, and Upper Falls plants, will become superintendent of the Chelan plant. Lyle Noble, station superintendent at Clarkston, Wash., will go to Spokane to take over Fryer's post.

A. F. Miller, station superintendent at Long Lake, Wash., will become superintendent of the plants at Lewiston and Grangeville, Idaho; and Clarkston, Wash.

E. E. Heflin, chief operator at Long Lake, will assume the post of superintendent there. Fred Anderson, B station operator at Long Lake, will move up to the chief operator's position.

C. M. Bennett, chief operator of B station at Nine Mile, will become superintendent at Post Falls, Idaho. H. W. Pederson, also B station operator at Nine Mile, will be advanced to chief operator there.

•

Paul Leman has been named vice president of Aluminum Co of Canada, Ltd. Leman, who joined Alcan in 1938, has been treasurer since 1949 and will continue to serve in this capacity.

Roscoe A. Williams has been made safety director of Arkansas Power & Light Co, succeeding Perry J. Bott who died in February. Williams has worked for Arkansas P&L for 15 years, advancing from apprentice in the meter department to assistant superintendent of distribution for the Little Rock Division.

Hollingsworth Is Head of Great Lakes Power

Lynn Hollingsworth has been elected president of Great Lakes Power Corp, Ltd, Sault Ste. Marie, Ont. He succeeds John A. McPhail who has retired after serving in that post 24 years. McPhail was named chairman of the board and chief executive officer of the company.

Hollingsworth was executive vice president of Sault Mill & Lumber Co until he retired recently. He was with the Sault company for 37 years.

The company supplies power to the Sault Ste. Marie district and the Michipicoten mining area.

W. C. Fisher has been named assistant district manager for Northern Virginia Power Co at Winchester, Va. He succeeds **Ronald Itnyre,** who was promoted recently to commercial manager for the utility at Frederick, Md. Fisher, who has been serving as local manager at Piedmont, W. Va., started with Northern Virginia in 1939.

James H. Doak, manager at Danielson for Connecticut Light & Power Co since November 1950, has been transferred to Berlin headquarters to assist Vice Pres A. S. Jourdan in the newly formed employee relations department. He will be responsible for job and wage administration. **W. E. Hughes,** manager at East Hampton, succeeds Doak and **Frank J. Mellon,** commercial manager at Thompsonville, becomes East Hampton manager.

John O. Fuchs has been appointed general operating manager in charge of all Central Hudson Gas & Electric Corp's gas and electric operations previously included in the gas operating, electric production and distribution divisions. He will report to the vice president in charge of operations and in his absence will report directly to the president and general manager.

C. W. Brissenden, assistant to the vice president in charge of operations for Portland General Electric Co, has been made general sales manager. He succeeds **A. C. McMicken,** who has retired after serving 40 years in that post. **Wallace E. Gordon,** assistant

Another ASCO Improvement

Relay 188S6

...featuring a unique combination of polarized relays with time delay for D-C Service

1. *each relay will respond to only one polarity and on momentary loss of voltage the energized relay does not move.*
2. *with sustained current off the relays are in open contact position.*
3. *relays are mechanically interlocked.*
4. *glass-enclosed.*

Thorough shop tests indicate that these latest ASCO polarized relays with time delay feature are definitely superior to any of those previously made. The glass cover is a feature which will appeal particularly to utilities.

Delay Timing for this Relay is similar to that of Bulletin 1054-188S announced last spring—at any point from ½ to 3 seconds, predetermined and set at the factory. It's a magnetically held Relay without dashpot, motors or other moving parts in the time element. It is rated at 25 amperes and embodies utility power construction.

This unit typifies what can be done with the ASCO Time Delay Relay. Our engineers will be glad to discuss its values in relation to your requirements along these lines.

S.50.9

ASCO Valves Solenoid Electric CONTROLS

Automatic Switch Co.

397 Lakeside Avenue Orange, New Jersey

Automatic Transfer Switches
Remote Control Switches
Contactors
Relays

We also manufacture a complete line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases.

PAGE FENCE - Since 1883

• AMERICA'S FIRST WIRE FENCE •

Security is vital today as never before. Protection at property lines has been the responsibility of Page Chain Link Fence for more than 60 years. There are fence styles and gates to meet any protective need. The expert erecting firm near you will supply facts and submit cost estimates without obligation. Firm name will be sent with fence data on request.

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

rate engineer, replaces Brissenden. The new general sales manager joined PGE in 1937. McMicken started with the utility in 1902.

Russell B. Read, former director of payroll accounting, has been appointed planning director for Westinghouse Electric Corp. In this newly established position, Read will represent the planning committee in assisting the various Westinghouse operating divisions throughout the country to make plans for new or additional product lines. Read's successor is **Frank H. Muns** who has been assistant director.

R. W. OWENS

Elliott Co Makes Owens a Senior Vice President

R. W. Owens has been made a senior vice president of Elliott Co, Jeannette, Pa.

Owens joined the Elliott firm in January, 1944, as assistant to the president. Later that year he was elected vice president in charge of manufacturing, which position he held until his new appointment.

Prior to joining Elliott he served with Westinghouse Electric Corp in various engineering capacities for 28 years.

Samuel B. Williams, who has been director of public relations for Sylvania Electric Products, Inc, since 1949, has been appointed assistant to the president. **George W. Griffin, Jr,** manager of General Electric Co's news bureau at Schenectady, N. Y., since 1945, succeeds Williams. Williams served as editor of Electrical World from

pick the brush Killer that's proved for the job!

When you pick a product for brush control, you can't afford to test 50 or more formulations to determine which one is best for the job. *But we did*—in cooperation with public utility companies, highway departments, railroads and spray service organizations. These tests on many species of brush in all sections of the country at all seasons of the year *proved* that Esteron* Brush Killer and Esteron 245 should be your first consideration in any successful brush control program. Here's why:

Both contain highly effective low volatility propylene glycol butyl ether esters which have been proved by actual use over thousands of miles of right-of-ways. Esteron Brush Killer, a mixture of the 2,4-D and 2,4,5-T esters, is widely used for control of mixed stands of brush. For certain resistant species that need a straight dose of 2,4,5-T—Esteron 245 is the ticket! It is successful also for year-around basal bark and stump treatment.

Both products have excellent storage qualities.

Yes, good results depend on the brush killer you use and how you use it. Pick the one that's *proved* for the job! You are invited to call on Dow sales and technical men for consultation on your brush control problems.

*ESTERON *is a registered trade mark of The Dow Chemical Company, largest producers of weed, brush and grass control chemicals.*

ESTERON BRUSH KILLER and ESTERON 245

CONTAINING NEW LOW-VOLATILITY ESTERS

THE DOW CHEMICAL COMPANY

Agricultural Chemical Department • Midland, Michigan

New York • Boston • Philadelphia • Atlanta • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

DOW
CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

JUMPER CLAMPS

ARMOR ROD CLAMPS

SPLIT BOLT CONNECTORS

WEDGE GRIP CONNECTORS

Sherman®

CONNECTORS

ARE RIGHT FROM EVERY VIEWPOINT

ENGINEERING

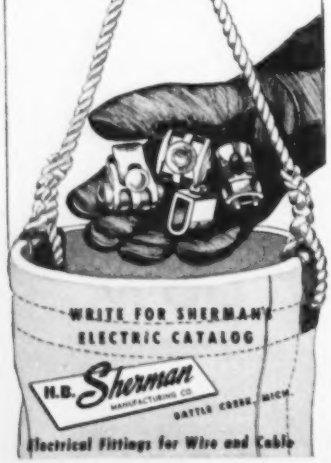
"Sherman Connectors are designed better . . . they're stronger, more dependable."

MANAGEMENT

"Sherman Connectors are not only highly satisfactory—they're priced right, too."

SUPERVISION

"My men work better and faster with Sherman Connectors."



Electrical Fittings for Wire and Cable

1937 to 1947, leaving to join Sylvania that same year. Griffin started with GE in 1936.

E. J. Otterbein, Davenport district manager for Iowa-Illinois Gas & Electric Co, has retired. He served the utility for 41 years.

Herman F. Lehman has been appointed general sales manager of Frigidaire Division, General Motors Corp. Lehman, assistant general sales manager for nearly ten years, succeeds **Philip M. Bratten,** who has been granted an indefinite extension of his leave of absence. Lehman joined Frigidaire in 1925.

James H. Elkus has been appointed assistant manager of the Blaw-Knox Division of Blaw-Knox Co, Pittsburgh, Pa. Elkus, who started with B-K in 1933 as a design engineer, has been manager of methods and procedures since 1943 and also has been active in the company's foundry modernization program and planning facilities for defense production since 1949. In his new post he will be responsible, under the division manager, for all departments of the fabricating unit which is located at Blawnox, Pa.

Paul Widenor, municipal engineer for New Jersey Power & Light Co, has retired after 33 years' service with the utility. He was appointed in 1945 to the position he has relinquished.

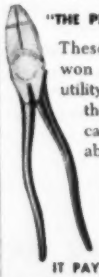
Frederick C. Stakel has been named advertising manager of Aluminum Co of America. Before this appointment he was manager of advertising and sales promotion for Brown Co of Berlin, N. H., manufacturers of pulp, paper, and allied products, since 1947.

John F. McDaniel has been promoted to the position of manager of marketing for Hotpoint, Inc, Chicago. McDaniel, who joined Hotpoint in 1934, was made assistant sales manager in 1948, moving up to sales manager in 1951. In his new post he will be responsible for directing all company marketing activities.

Ransom Cooper, Jr, has been appointed manager of the nickel sales department and **H. D. Tietz** manager of the Inco nickel alloys department of the International Nickel Co, Inc. Cooper came to International Nickel

RUBBER HANDLES

These heavy, black vulcanized rubber handles are a wonderful addition to the great LUBRING lineman's pliers. They are designed to add extra comfort, long wear and protection—and are available on many UTICA models.



"THE PLIERS THAT OIL THEMSELVES"

These fine LUBRING pliers have won a wide acceptance among utility people as "the pliers that oil themselves". Porous iron lubricating ring "floats" in the joint, absorbs lubricant and feeds it as needed. Keeps joint smooth and free working.

The **LUBRING** *feature is available in 9 other useful models.*

IT PAYS TO USE QUALITY TOOLS
and the world's best tools are made in U.S.A.

U TI CA®
DROP FORGE AND TOOL CORPORATION
NEW YORK

In Canada
ADLAM TOOL & SUPPLY CO., LTD., MONTREAL;
WALLS-IRONS, LTD., WINNIPEG

in 1929 and has been serving as assistant sales manager of the nickel sales department. Tietz joined the company in 1931 and has been assistant to the manager of the Inco nickel alloys department since 1941.

Joseph E. Foley, Jr, has been made manager of sales promotion and advertising for Edward Valves, Inc, East Chicago, Ind., a subsidiary of Rockwell Manufacturing Co, Pittsburgh. Foley formerly was a divisional advertising manager for the American Brake Shoe Co, New York.

OBITUARY

Jaroslav G. Hlavac, 53, section engineer in charge of electric transmission and distribution for Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y., died May 17. He had been with Central Hudson since 1925.

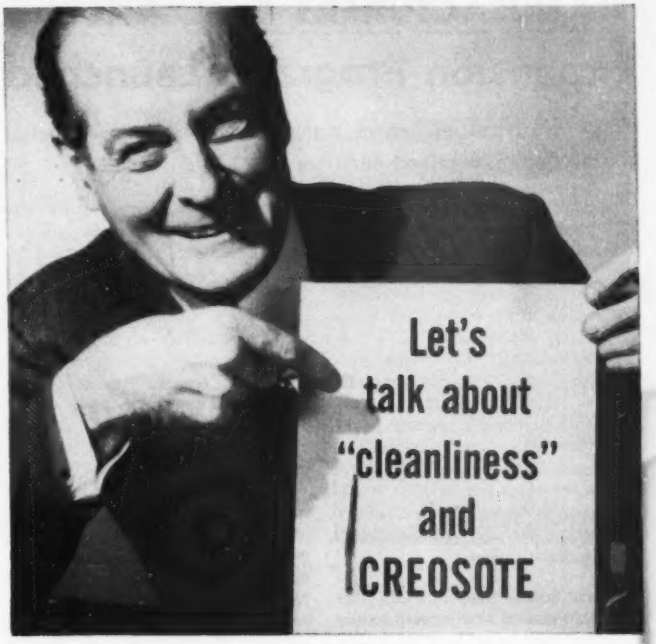
Kerien L. Fitzpatrick, 66, manager of public relations and advertising of Dayton Power & Light Co, died May 15. He joined DP&L in 1912 and was named to his last position in 1945.

E. V. Freeman, 64, manager of the electric sales department of Louisville (Ky.) Gas & Electric Co, was found dead in his automobile after it crashed into a tree in Louisville May 22. Freeman has been with the utility for 25 years. Prior to this he worked for Westinghouse Electric Corp as a salesman from 1911 until he came to Louisville G&E in 1927.

Frank C. Perkins, 56, manager of the parts manufacturing department of General Electric Co with offices at Nela Park, Cleveland, died May 14. Perkins, who joined GE in 1919, had held the manager's post since 1947.

Edward H. Maurer, 76, retired executive of American Gas & Electric Co, New York, died May 19 at Elizabeth, N. J. Maurer, who became associated with American G&E in 1912, was vice president of its operating affiliates and assistant treasurer of the company and its service corporation before his retirement in 1945.

R. B. Brown, 80, retired president of Madison (Wis.) Gas & Electric Co, died May 20 at Bellingham, Wash. He retired in 1939.



Today's modern Wood Preserving Plants know how to protect poles with creosote and leave them dry and "clean." Specifications for clean treatment, when combined with proper specifications for the creosote used, provide "complaint-free" poles.

One of the largest producers of pressure-creosoted poles reported to us: "We haven't had a single complaint about the cleanliness of the last million yellow pine poles treated with creosote."

For poles that are *clean*—for poles that *will last*—specify "dry pressure-creosoted poles."

KOPPERS COMPANY, INC., PITTSBURGH 19, PA.
Tar Products Division

You can count on Koppers for Creosote!

KOPPERS
All Standard Specifications
Creosote
The Performance-Proved Wood Preservative

Expansion Programs Launched

Electrical equipment manufacturers begin construction on their new plants and additions

From coast to coast electrical equipment manufacturers have launched building expansion programs.

Among the companies which have hopped on the expansion band wagon is General Electric Co. GE's Carboloy Department has started construction of a 90,000-sq ft permanent magnet manufacturing plant at Edmore, Mich. When completed in the spring of 1953, it will represent an investment of more than $3.5 million. The plant, which will have about 150 to 200 workers, will rise adjacent to Carboloy's new $1.5 million carbide tool fabricating plant.

To Build Service Shop . . . GE plans construction soon of a modern service shop and warehouse in Philadelphia, Pa., consisting of more than 110,000 sq ft of space and including 5,000 ft for offices. The shop, estimated to cost $1.5 million, will provide facilities for maintenance and repair work on GE motors, switchgear, and other equipment serviced in the Philadelphia area.

The company's Tube Department now has under construction a new, $875,000 electronic tube warehouse in Chicago. The one-story brick building, which will have 90,000 sq ft of floor space, including 7,600 sq ft of office space, will serve as sales headquarters, warehouse center, and commercial service headquarters for the Tube Department's central regional operations, which serves 16 central and midwestern states. The new unit, which is expected to be ready for occupancy by the end of this year, is the third major addition to the GE tube warehouse system in recent months. Eastern and southern regional warehouses have been established recently at Clifton, N. J., and Owensboro, Ky.

General Electric will officially dedicate its new automatic blanket and heating pad plant at Asheboro, N. C., June 11-14.

$6-Million Lab . . . Westinghouse Electric Corp has broken ground at its South Philadelphia works for a $6 million steam and gas turbine development laboratory. Construction of the four-story, brick and structural steel building will begin late this summer and will take about a year to complete. The facility, which will employ a staff of nearly 100 engineers and technicians, is being built to maintain the flow of knowledge necessary for future improvements and new discoveries and developments in power generating equipment.

Westinghouse also plans to build a multi-million dollar electric meter manufacturing plant near Raleigh, N. C., which will be operated by the firm's Meter Division located at Newark. Ground will be broken within a few weeks on the 100-acre site.

The one-story, brick plant, which is expected to be completed July 1, 1953, will have an interior area of approximately 500,000 sq ft. This addition is expected to provide employment for more than 2,500 persons.

Negotiating Lease . . . Sylvania Electric Products, Inc, has announced it is negotiating a lease for a 50,000-sq ft factory to be erected in the York, Pa., area. When completed by the year-end, the plant, which will be used for fabrication of metal parts, will have about 250 workers. It will permit the company to expand its metal fabrication operations and provide facilities for several new projects now under consideration.

Plans have been completed for construction of a branch factory, office, and warehouse at Seattle, Wash., by the Square D Co, Detroit, Mich. The building will have 21,000 sq ft of factory space, which is expected to be more than doubled at a later date, and 3,600 sq ft of office space.

Gets Tax Write-Off . . . Combustion Engineering-Superheater, Inc, New York, will move ahead with plans to increase its production of power boilers by 50% now that the Defense Production Administration has granted a certificate of necessity for tax amortization of cost of expansion to total about $5,800,399. The certificate allows rapid tax amortization for $2,900,184, half the amount of expansion. The firm plans to add 120,000 sq ft of floor space in three new building additions to its Chattanooga (Tenn.) Division. It expects to employ 500 additional employees, thus bringing the total up to 4,000.

Following recent ground breaking ceremonies, the D. J. Murray Manufacturing Co, Wausau, Wis., started construction of an addition of 37,000 sq ft to its present plant. Completion of the new, two-story plant is scheduled for September.

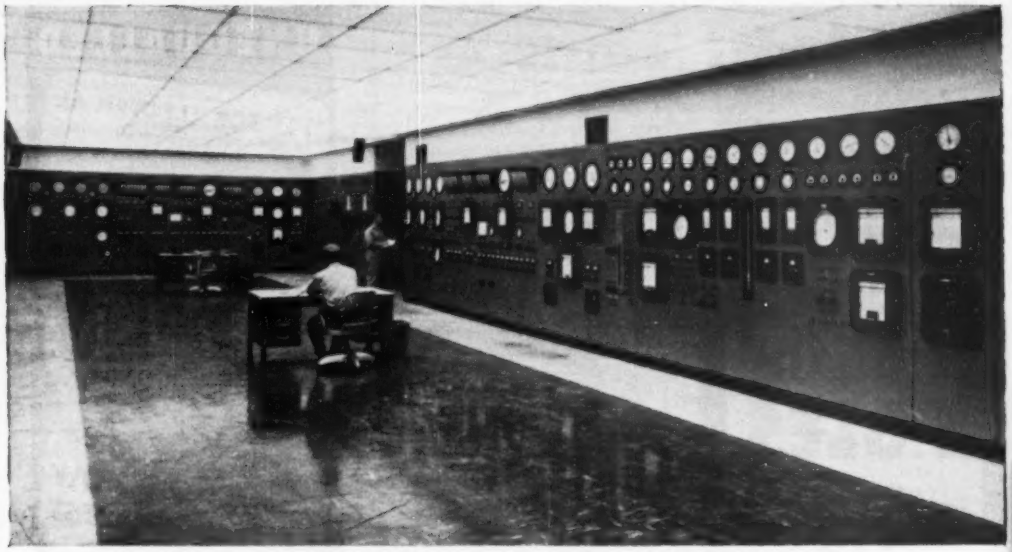
Rural Transformer & Equipment Co, Milwaukee, Wis., has expanded its facilities through the acquisition of a new plant at Waukesha, Wis. The building, approximately 10,000 sq ft with five acres of land for expansion, is equipped for production of transformers ranging in sizes 3 through 500 kva.

Reynolds' Brazil Plant Meets with Opposition

Reynolds Metals Co's preliminary proposal to establish a large-scale aluminum plant in Brazil, using power from the government-financed Paulo Afonso Falls hydroelectric station, has raised a considerable storm in official and industrial circles in Rio de Janeiro. Despite an initial "go ahead" signal from President Vargas to the Commission for Industrial Development the proposition has been met with opposition.

The commission, charged with examining and passing on proposals from foreign investors who would like special import or tax privileges to help get started, has held several hearings. It looks as though the Reynolds project will be pigeonholed until the company comes up with a detailed statement of just exactly where, how, and when it would build its plant, what it will cost and how it will be financed, and what benefits it will bring to Brazil. The current discussions are based solely on a general scheme, and not on a project survey.

Opponents of the plan have asserted that while Reynolds would supply



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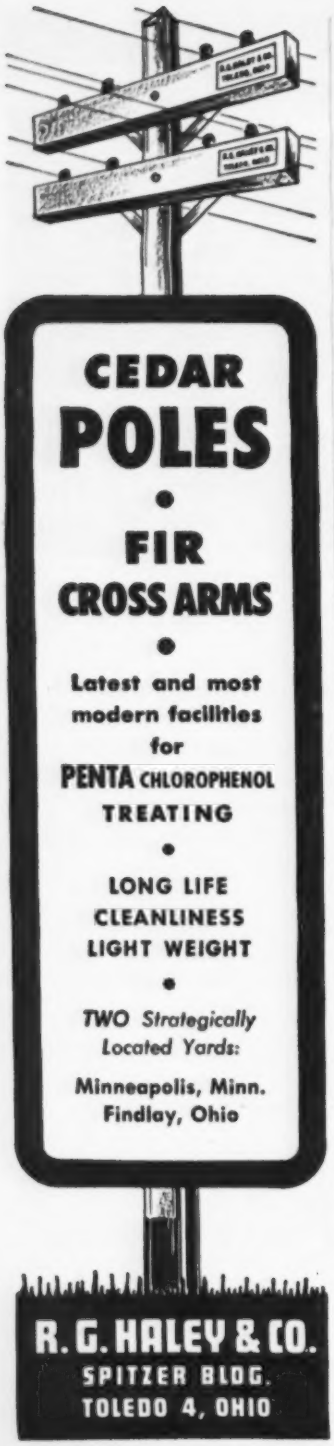


Brazil with foreign exchange, since the metal product would be almost entirely for export, it really would not contribute to the industrial needs of the country since plants now in operation or soon to start can meet domestic requirements. Furthermore, the drawing off of a large block of power for the plant would defeat the purpose of Paulo Afonso, which was to supply power to a large undeveloped area. It is felt, too, that it would be unfair to grant Reynolds cheap government power while the other producers have gone to very heavy expense to construct their own power sources.

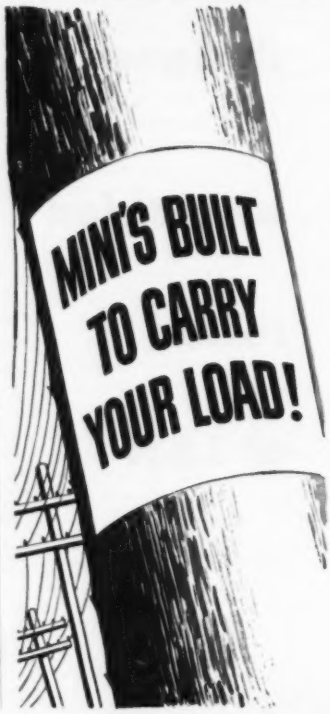
Officials of the Cia. Hidro-eletrica Sao Francisco, which is building Paulo Afonso and which will run it, are proving chief spokesmen for Reynolds. They assert that the Reynolds project definitely would not prejudice development of the area.

Paulo Afonso's first stage of development, 180,000 kw generating capacity, will take care of the needs of the general area at least until 1959, they have testified. If Reynolds gets the official green light, then work can begin at once on the second stage of another 180,000 kw of which Reynolds would use approximately 120,000 kw.

With Reynolds assured as a customer, they claim, the cost of Paulo Afonso power could be substantially reduced. Instead of the 13 centavos (U. S. .65¢) per kwhr calculated as the charge during the first stage, a charge of only half this would be possible over the whole system. This would not prejudice the area's general development, therefore, but actually assist it.

Return Reels Real Quick

Because manufacturers of wire and cable currently are plagued by shortages of reels and spools used for delivery of their products, they have sent out an urgent call requesting customers to return reels and spools for refill. The drum-type reels are of rolled steel and are very difficult to come by. The flanges, generally, are made of spruce and the lumber must be seasoned; otherwise the joints will open up. The older, more seasoned reels and spools "stranded" on the back lots of wire and cable users are more dependable and, therefore, should be put to work.



New Electrical Construction

New electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included.

UTILITIES

Proposed Construction

Arizona-California—Bureau Reclamation, Dpt. Interior, Phoenix, Ariz., constr. 26 five-room and 20 six-room residences with utilities for Parker Dam Government camp, Parker Dam Power and Davis Dam Projects, Spec. 300C-35. L. N. McClellan, Bld. 1A, Denver Federal Center, Denver, Colo., ch. engr.

California—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., circuit breakers, disconnecting switches, switches, for Folsom & Nimbus switchyards and Folsom-Elverta terminal switching facilities, Central Valley Proj., American River Div. Spec. DS 3719. L. N. McClellan, ch. engr.

Colo., Holyoke—Electric Assn., Holyoke, soon lets contract garage and warehouse with offices, $103,000. J. E. Loftus, Omaha Natl. Bk. Bldg., Omaha, Neb., archt.

Kansas—Norton Decatur Co-operative Electric Co., Norton, 250.3 mi. rural distr. lines, 42.97 mi. of conversion lines, Decatur, Norton, Graham, Phillips, Rooks and Sheridan Counties, $350,000. Raymond H. Reed & Co., Columbus, Neb., engrs.

La., Shreveport—U. S. Eng., 300 Broadway, Little Rock, Ark., Job No. AFB 52-ACRP-AF electric distr. sys., primary line only, FY 1952 addns., Barksdale Air Force Base, Eng. 03-050-52-33.

Michigan—Cloverland Electric Co-operative, Sault Ste Marie, 247 mi. rural distr. lines, 22 mi. electric transmission line system imprvs., Chippewa Co. $1,200,000.

Missouri—Missouri Public Service Co., Ralph J. Green, pres., Warrensburg, 69,000 volt electric transmission line between Appleton City and Clinton.

Pa., Sharpsburg—Boro of Sharpsburg, 1626 Middle St., power plant imprvs. $300,000.

S. C., Fort Jackson—U. S. Eng., Customhouse, Charleston, rehabilitation electric distr. sys., ENG 38-041-52-74.

South Dakota—West Central Electric Co-operative, Murdo, construct 724 mi. rural distr. lines, Jones, Lyman and Stanley Counties, $875,000; 558 mi. rural distr. lines and 11.25 mi. of conversion, Haakon, Jackson and Washabaugh Counties, $50,000. Ulteig Eng. Corp., 1114½ Front St., Fargo, N. D., engrs.

Tenn., Nashville—State of Tennessee, Nashville, misc. electrical work at Tennessee A. & I. State University. Plans deposit $50. McKissick & McKissick, Morris Bldg., archts.

Tex., Houston—Electro-Technical Laboratories, Inc., 504 Waugh Dr., Houston, mfg. plant, $100,000. Woestemeyer & Gaffney, 4132 Coleridge St., archts.

Wash., Seattle—Dpt. Army, Contg. Officer, Fort Lawton, replacing power line at Seattle Port of Embarkation, Inv. 52-47.

Wyoming-Montana—Bureau Reclamation, Dpt. Interior, Cody, Wyo., Lovell-Yellowtail 115-kilovolt transmission line, Transmission Div., Missouri River Basin Proj., Spec. DC 3555. Extended date. L. N. McClellan, ch. engr.

Low Bidders & Contracts Awarded

Ark., North Little Rock—Ebasco Service, Inc., 2 Rector St., New York, N. Y. CA $13,000,000, erect power plant addns. Arkansas Power & Light Co., Simmons National Bldg., Pine Bluff, Ark.

Ark., Stamps—Ebasco Service, Inc., 2 Rector St., New York, N. Y. CA $13,000,000, erect power plant addns. Arkansas Power & Light Co., Simmons National Bldg., Pine Bluff, Ark.

California—Pacific Oerlikon Co., 3001

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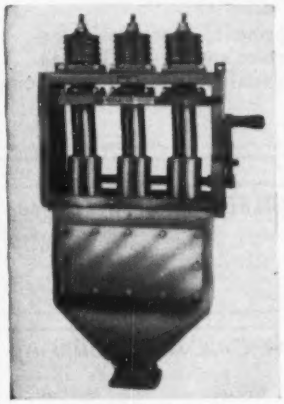

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N. Starr St., Tacoma, Wash. LB $450,000, furnishing, installing two 7,500 kva. vertical shaft generators for Nimbus power plant, Central Valley Proj., American River Div. Spec. DC 3696. Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo. Bids May 8.

Fla., Jacksonville—Westinghouse Electric Corp., East Pittsburgh, Pa., CA $2,368,000, two 40,000 kw turbine generator units for expansion to city electric power system, City, City Hall, Jacksonville, Fla. Reynolds, Smith & Hills, 227 Park St., Jacksonville, engrs.

Fla., Pensacola—Baroco Electric Constr. Co., 17 W. Garden St., Pensacola, Fla., LB, $71,757, conversion of 18 buildings for overhead and repair electronics shop, Officer-In-Charge of Construction, U. S. Naval Air Station, Pensacola, Fla.

Mass., Braintree—Power Piping Corp., 46 First St., Cambridge, Mass. CA $104,500, power house piping. Town, Electric Light Dpt., 44 Allen St., Braintree, Mass.

N. J., Glassboro—Lewis C. Bowers & Sons, Inc., 341 Nassau St., Princeton, N. J., CA, $200,000, 1 story, 125x135 ft. brick, structural steel, service Bldg. Atlantic City Electric Co., Kentucky Ave. and Pacific Ave., Atlantic City, N. J.

Oklahoma—Guthrie Electrical Constr. Co., 1325 Grimmit Dr., Shreveport, La., LB $187,235, installing sub-station, 138 kv. near Anadarko, Caddo Co. Southwestern Power Admin., Dpt. Interior, c/o Floyd E. Conway, Div. Eng., P. O. Drawer 1619, Tulsa 1, Okla. Bids Apr. 23.

R. I., Quonset Point—Jefferson Constr. Co., 75 First St., Cambridge, Mass., CA $608,209, electronics shop addn. to Bldg. 60, Naval Air Station, Spec. 31293, P. Wks. Office, First Naval Dist., 495 Summer St., Boston, Mass. Bids Apr. 24, awarded May 1.

Ont., Islington—Ramsey Contg. Co., 170 Perth Ave., Toronto, Ont., CA, $250,000, 1 story, bsmt., 115x120 ft., concrete block, brick, power station. Etobicoke Hydro-Electric Power Comm., 4969 Dundas St., W., Islington, Ont. Bids May 5, awarded May 12.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., Los Angeles—Veterans Admin., Munitions Bldg., 21 St. and Constitution Ave., Wash., D. C., construction and finishing complete Veterans Administration Hospital (1) general construction; (2) electric elevators; (3) refrigeration equip. and (4) laboratory equip. Spec. 5200, Proj. 12-4075. $19,000,000.

Mich., Detroit—City-County, Detroit-Wayne Joint Bldg. Auth., A. E. Cobo, chn., City Hall, 550,000 sq. ft. cellular steel sub floors for city-county bldg., incl. complete header svs. for elec. and communication svs. $17,000,000. Plans deposit $35 refundable. Harley, Ellington & Day, Inc., 153 E. Elizabeth St., archt.

Mo., Pleasant Hill—Missouri Public Service Co., Ralph J. Green, pres., Warrensburg, 27,000 kw. turbo-generator power generating plant, incl. 200,000 lb. per hr. steam boiler, etc., $5,000,000.

N. J., Gibbstown—Hercules Powder Co., Delaware Trust Bldg., Wilmington, Del. hydrochemical plant, incl. railroad spur, sewage and water lines $18,000,000.

O., Cleveland—Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash. 25, D. C., 500-bed hospital, $11,000,000.

Ore., Portland—State Bd. Higher Educ., Eugene, 14 story, teaching hospital University of Oregon Medical School, $6,000,000. Extended date. Plans deposit $100. Lawrence, Tucker & Wallman, Failing Bldg., Portland, archts.

Tex., Pampa—Celanese Corp. of America, 180 Madison Ave., New York, N. Y., celanese plant, Kings Mill, near here $5,000,000.

Wash., Walla Walla—Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash. 25, D. C., 2 ward bldgs. at Veterans hospital, $4,000,000.

Low Bidders & Contracts Awarded

Pa., Phila.—Turner Constr. Co., 1500 Walnut St., Phila., Pa., CA $4,000,000, shopping center, and parking area, Roosevelt Blvd., Magee Ave., etc. Boulevard Center, Inc., Maurice R. Massey, Jr., pres., 1426 Walnut St., Phila., Pa. Sweet & Schwartz, 156 N. 20 St., Phila., Pa., archt.

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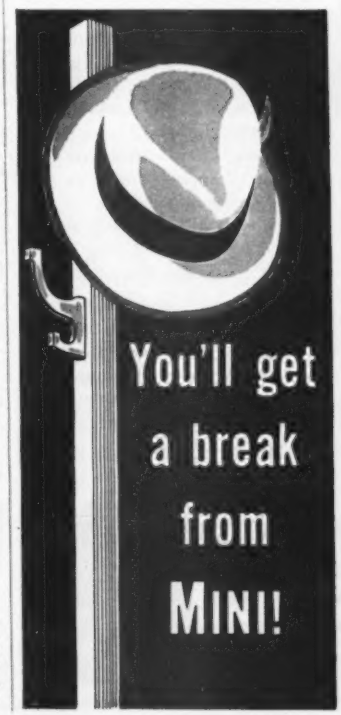

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Electrical Planning Guide—The integration of electrical equipment into the planning of modern homes is greatly facilitated by a new 20-pg booklet now available. How to select, group, combine and fit equipment for the modern home is discussed along with photos and diagrams. For a copy of B-5479, write Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Equipment List—The Underwriter's Laboratories Inc, of Chicago, Ill. have published their latest *Gas and Oil Equipment List* in the form of a 240-pg manual. For information about this booklet write the main office in Chicago or their branch offices in New York and San Francisco.

Capacitor Units—The latest edition of the *American Standard for Capacitor Units*, C55.1-1951, approved by American Standards Association is now available. It covers shunt and series capacitor units for use on ac power transmission and distribution systems at nominal frequencies of 60 cycles and below, used for the purpose of modifying the performance of systems at normal frequencies. Copies available from ASA, 70 East 45 St, New York, N. Y. and AIEE, 29 West 39 St, New York 17, N. Y. at 40 cents per copy.

Technical Ceramics—A detailed report entitled *50 Years of Progress* on the custom manufacture of technical ceramics containing pictures and diagrams is now available. Of great value to designers, engineers and purchasing agents dealing with technical ceramics it may be obtained by writing the American Lava Corp, Chattanooga 5, Tenn.

Paper and Paperboard—The revised and expanded edition of the 1944 Monograph on Paper and Paperboard is now available. It provides expert and critical discussion of tests, and defines terms, nomenclature, and properties of paper related to these tests. Copies of this 140-pg publication, *Paper and Paperboard STP No 60-A*, may be obtained from the American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa at $2.50 per copy.

Electric Laundry Equipment—A section of the Domestic Appliance Installation Manual prepared by the Wiring and Specifications Committee of Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. may now be obtained. It is entitled the *Electric Laundry Equipment Section*.

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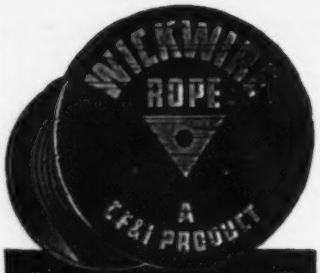

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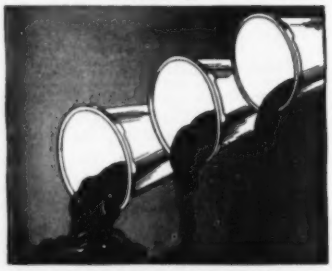

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or Phone PE 6-6531, Mr. Halfen

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Santa Clara — California

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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn

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POSITION WANTED

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U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3719) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, June 24, 1952, for furnishing four 230-kv (900-kv basic impulse insulation level), 3-pole, 1,200-ampere, 7,500,000-kva, outdoor power circuit breakers; fourteen 230-kv (900-kv basic impulse insulation level), 3-pole, 1,200-ampere air switches; and six 115-kv, 600-ampere, 3-pole, outdoor air switches for Folsom and Nimbus Switchyards, Central Valley Project, California. Delivery is desired within 540 days. For particulars address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

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SW-3777, Electrical World
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SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
2	3333	West.	132000—7620/13200 Y
3	75	A. C.	66000/34500—7200/12470 Y
4	2500	West.	44000—11000
3	150	G. E.	44000—7200/12470 Y
3	100	G. E.	44000—2300
3	75	West.	44000—7200/12470 Y
3	3333	West.	43800—13800
1	15750	A.B.B.	34840—11000, 3 ph.
8	100	West.	33000—240/480 NEW
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
4	4500	A. C.	23410/44000—13200/23000
6	100	G. E.	22000—7200/12470 Y
9	50	G. E.	22000—2300
3	37½	G. E.	22000—6900
6	200	G. E.	13200—2300
4	333	Wag.	7200/12450 Y—2300
3	250	Pitts.	7200—220/440
3	100	Wag.	7200/12470 Y—2400
6	25	Mol.	7200/12470 Y—120/240
3	500	Pitts.	6900/11900—550
3	333	Pitts.	6900/11900—550
3	150	Wag.	6900—2300
3	200	G. E.	6600/11430—575
1	37½	G. E.	6900—230/460
2	150	West.	4800/8315 Y—480
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2300—230/460
1	100	G. E.	2300—675, 3 ph.
3	100	West.	2300—460/230
3	75	Mol.	2400—120/240
6	50	West.	2400—114/228 DRY TYPE
8	20	West.	2200—575

INDUCT. REGULATORS—OUTDOOR

1— 140 KVA G. E. 200 A. 4000 V. 3 ph.
1— 46 KVA West. 200/400 A. 2300 V.
8— 36 KVA West. 150/300 A. 2400 V.
2— 35 kva G. E. 75/150 A. 4800 V.

CIRCUIT BREAKERS

1— 600 A. 73 KV G. E. FHKO-236-500 MVA
1— 400 A. 37 KV G. E. FHKO-236-500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
1— 600 A. 15 KV G. E. FHKO-139-500 MVA
2— 600 A. 15 KV G. E. FHKO-136-1328 BS
4— 600 A. 15 KV G. E. FHKO-139-750 MVA
2— 600 A. 15 KV G. E. FLO-15-240 MVA

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A.C.—50 AND 60 CYCLES

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KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1136	Fairbanks Morse	38D	1600	720	320	Enterprise	DeG-6	560	480
1100	General Motors	16–278A	1600	720	300	General Motors	8–268A	450	1200
750	General Motors	12–567	1080	720	300	General Motors	6–268A	350	900
600	General Motors	8–278A	750	720	100	General Motors	3–268A	150	1200
500	General Motors	6–567	720	720	100	Worthington	BB-5	150	600
350	Baldwin	VO-6	510	450	60	General Motors	6–71	90	1200
320	Buckeye	80	480	600	30	Internat'l Harvester	UD-14	45	1200

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ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

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Qu	KW	Make	Desc.
1—	6000	Al. Ch.	Condensing 300/250 I.S.P. 2300 v 3 ph 60 Exc. & Surf. cc Cond.
1—	750	G.E.	Condensing — 425 lbs. 750 'TT I.S.P. 440 v. 3 ph. 60 cy.— Built 1944
1—	50*	Moore	Non-condensing, 150/200 lbs. I.S., 8/15 lbs. G.B.P. 3/60/480 volts Direct Connected Exciter
1—	400	Westg.	Non-condensing — 125/150 lbs. I.S.P. 5/10 lbs. B.P. — 240/480 v. 3 ph. 60 cy.
1—	300	G.E.	Non-cc densing 150/175 I.S.P. 5/10 B.P.— 480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
1—4000	Whse		2400/4150	600

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2—	2000	G.E.	500	625 DC cy.	11000
1—	1500	G.E.	72	600	13200
1—	1500	G.E.	360	275	2300/4400
1—	1000	G.E.	900	280	4100, 6900
1—	1000	G.E.	600	600	2300/4150
2—	1000	Whse.	900	600	2300/4150
1—	500	Whse.	900	250	6600/11200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	250	G.E.	900	125	4150
1—	150	G.E.	1200	275	2300
1—	150	Whse	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
3—1250	G.E.	HVDDJ		6600x550
3—1250	G.E.	BT	3	2300x/11200x440/2300
1—1150	A.C.	OISC	3	13200x480/2400
3—1000	G.E.	HVDDJ		2200x440
3—	500	A.C.	OISC	1	11800x3800
9—	300	G.E.	BT	3	24000x240/480

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1—1500 KVA G.E., 3 Ph., 4150V. 2300V Pyranol
1—1500 KVA Penn. 3 ph., 4150V. Y 2400V Delta
1— 200 KVA G.E., 3 Ph. 2400–230 Sec.
3— 100 KVA Wagner, 1 Ph., 2400 pri., 120 sec.
2— 100 KVA Newark, 440V 3 Ph., 220V 2 Ph.
6— 50 KVA G.E., 1 Ph., 13,450V. 120/240 Sec.
3— 25 KVA G.E., 1 Ph., 2400V. sec., 110/220 sec.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach. 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1000 RPM. 220V.
2— 150 H.P., Al. Chal. 360 RPM, 440V.

MOTOR GENERATOR SETS

1—1000 KW G.E., 600 V. 514 RPM. 4000V 6o.
1— 300 KW Whse., 275V. 900 R.P.M., 220 V 6yc.
1— 175 KVA West., 1 Ph., 220V. Motor 3 Ph., 440V.
1— 150 KW. G.E., 120/250V, 1200 RPM, 2300 6yc
1— 100 KW G.E., 250V, 900 RPM, 2300V, 6yc.
1— 75 KW C.W. 250V. 1200 RPM. 2300/3150V 6yc.

SLIP RING MOTORS

1— 200 H.P., West. CW, 600 RPM, 440V.
1— 250 HP West., CW, 600 RPM, 440V.

SYNCHRONOUS CONDENSER

1—200 H.P. West. CW, 600 RPM, 440V.
1—2500 KVA Whse., 720 RPM. 2300V with DC EXC.

Large Stock of A.C. and D.C. Equipment

LETTERS TO THE EDITOR

Rubber Insulation, not Paper

To the Editor:

When I read your Technical Notes column in the May 5 issue of Electrical World, the third item disturbed me in no small measure. As far as our experience is concerned, paper insulation is slowly vanishing and is being superseded by rubber insulations such as our famous Simplex Anhydrex XX insulation.

This has not only been our experience but we understand it is a common industry trend. Would you tell me on what facts you based this item?

E. J. MacKenzie
Advertising Manager
Simplex Wire & Cable Co
Cambridge 39, Mass.

To the Editor:

In your Technical Notes column in the May 5 issue there appears a statement that seems entirely contrary to the facts . . . Neither our field experience nor orders received bears out these facts and we have had similar information from other manufacturers at technical meetings.

It is true that varnished cambric cable is being used less and less for voltages above 7.5 kv. Instead, paper and, more especially, rubber are being used because of their greater economy, either from the installation or operating standpoint. More important is the fact that rubber is also replacing paper in a great many cases for applications above 7.5 kv.

There are available excellent rubber insulations for high voltage applications, our company having made them for use in installations that operate at as high as 35 kv. It is quite common today to use rubber for 15-kv service for power distribution and for station applications. The most prominent use for rubber insulation at high voltages is in submarine cables, where we have installations operating at as high as 35 kv. It will be remembered that the famous Bonneville submarine power cable installed last year was designed for 25-kv service.

Contrary to the information in your Technical Notes, rubber is receiving wider and wider recognition as an excellent insulation for use above 7.5 kv, and particularly in the 15-kv range.

Richard S. Hayes
Advertising Manager
The Okonite Co
Passaic, N. J.

• Basis for the technical note is this paragraph in the introduction to the EEI Cable Operation Report for 1948 (published 1951):

"The present report contains data on paper-insulated cable in ducts only, including pipe-type cable. Rubber and varnished-cambric-insulated cables have been dropped from the report. The amount of this type of cable in service is less than 1% of the total amount of cable contained in the report. Its use in high-voltage (above 7.5 kv between phases) underground systems has been gradually decreasing."

Member Wants to Know

To the Editor:

I was very much pleased to read the editorial on page 88 of the March 10 issue entitled "Democracy in AIEE," and I admire your courage in publishing it. I think that if we had more people who were willing to put their necks out we'd probably have a much better AIEE.

If there is anything I can do to further the thoughts expressed in the editorial and return the selection of officers in the AIEE to the membership, I certainly want to know about it.

F. S. Bacon, Jr
Registered Professional Engineer
20 Harmon Street
Hamden 14, Connecticut

• To reader Bacon goes Electrical World's thanks for an overly-large measure of praise.

Armor Protects ACSR

To the Editor:

Your "Technical Notes" in the March 31 issue of Electrical World included an item saying "Sharp bending of ACSR distribution wire around dead-end spools has deformed the aluminum to the point of exposure and failure of the steel core."

The way this is stated makes it appear as if such a condition is common and that there is no way to prevent it. The fact is that in a properly constructed, loop-type dead-end, the ACSR will not be deformed. The use of flat armor wire wrapped around the cable will prevent such a situation from occurring.

Robert F. McGeever
Aluminum Company of America
Pittsburgh 19, Pa.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Junction boxes designed for compact installation of copper conductors will often accommodate aluminum conductors with difficulty unless higher heat resistant cable insulation is adopted to compensate for the differences in diameters.

Motor starting currents are of short duration. Some ammeter damping is such as to prevent a fair reading.

Paper-insulation has almost completely superseded rubber and varnished cambric insulation for cables above 7.5 kv.

Trichlorbenzene added to pentachlor diphenyl results in a capacitor kraft-paper impregnant that has satisfactory corona voltage starting level as low as —94 F.

SINCE 1933, utilities all over the country have brought the advantages of low-cost, accurate ⅝% step voltage regulation to distribution feeders with Allis-Chalmers ⅝% step regulators. Nineteen years of experience have proved that the accuracy, reliability, and low maintenance requirements of Allis-Chalmers regulators increase profits.

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Best of all, this accurate, reliable voltage regulation comes at low cost. The low price tag on Allis-Chalmers distribution regulators plus low installation and maintenance costs means that these regulators pay their own way in increased revenues in a short time.

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A-3665

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5000 VOLTS — 50-100 AMPS
2500 VOLTS — 100-200 AMPS

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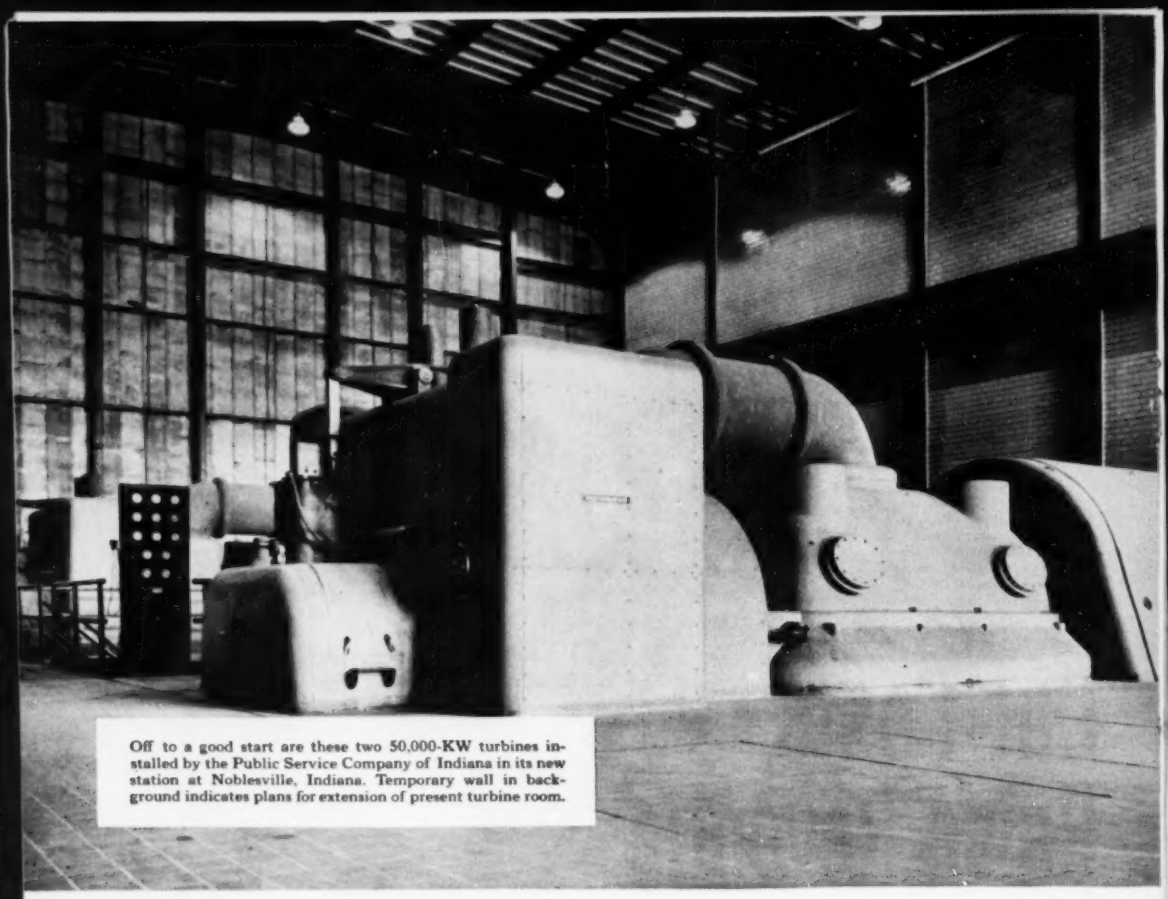

Off to a good start are these two 50,000-KW turbines installed by the Public Service Company of Indiana in its new station at Noblesville, Indiana. Temporary wall in background indicates plans for extension of present turbine room.

New turbines with the future guaranteed

● When these two 50,000-KW turbines were placed in service recently for the new Public Service Company of Indiana generating station at Noblesville, Indiana, NONPAREIL Turbine Oil was used for the initial fill . . . assuring trouble-free lubrication for the life of the turbines themselves.

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